

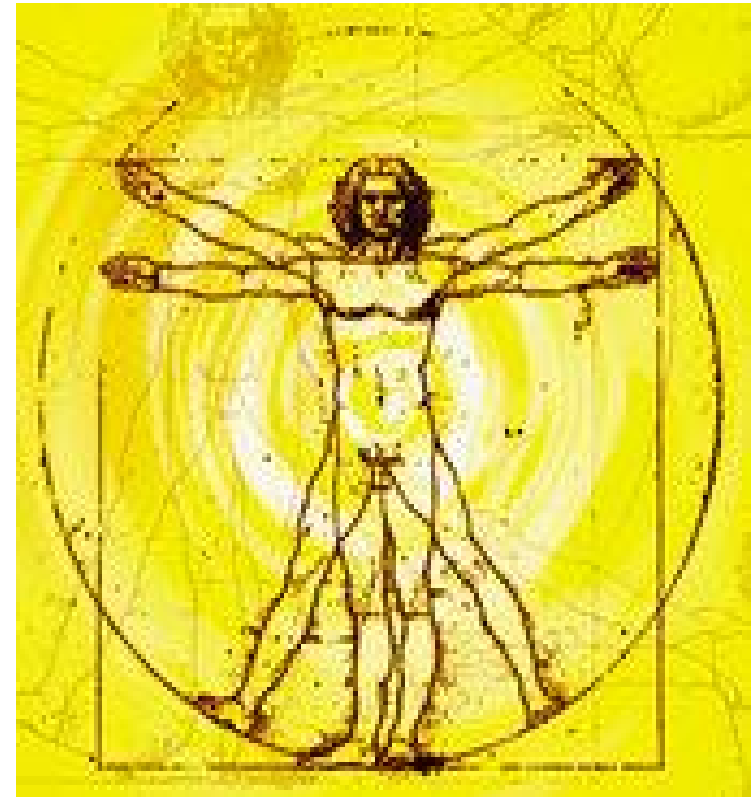
Smalltalk In The SAP World

”Driving Innovation by Exploratory Modeling”

Andreas Tönne
Lead Consultant
Cincom

Ralf Ehret
Development Architect
SAP AG

Elmshorn, November 2007



SIMPLIFICATION THROUGH INNOVATION™

THE BEST-RUN BUSINESSES RUN SAP™ 

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Who we are ...

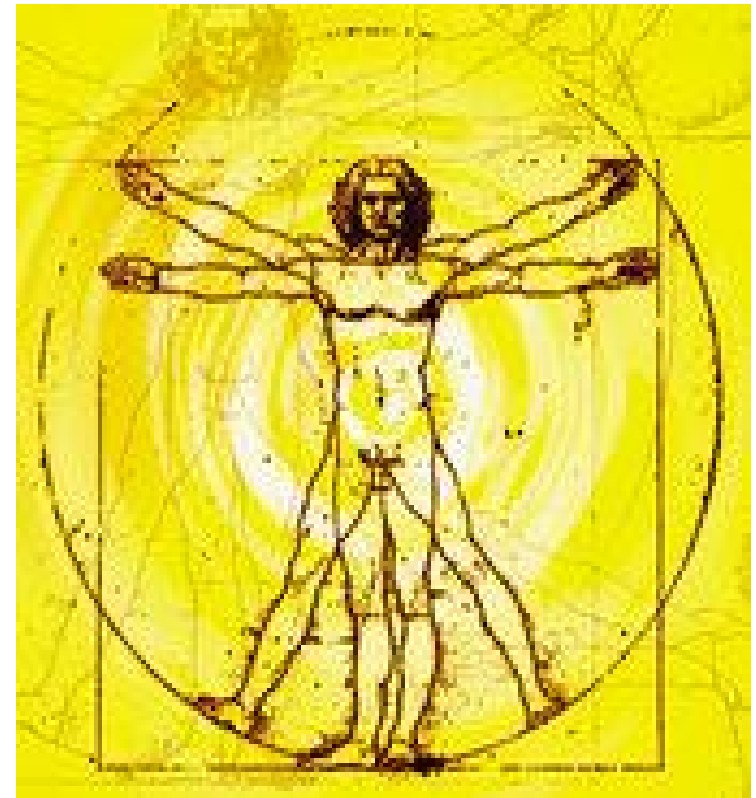
How to do xM ...

How xM works ...

Duplicate Analyzer –
An A/P Clerk Solution

xCarrier –
A Shipping Manager Solution

Summary



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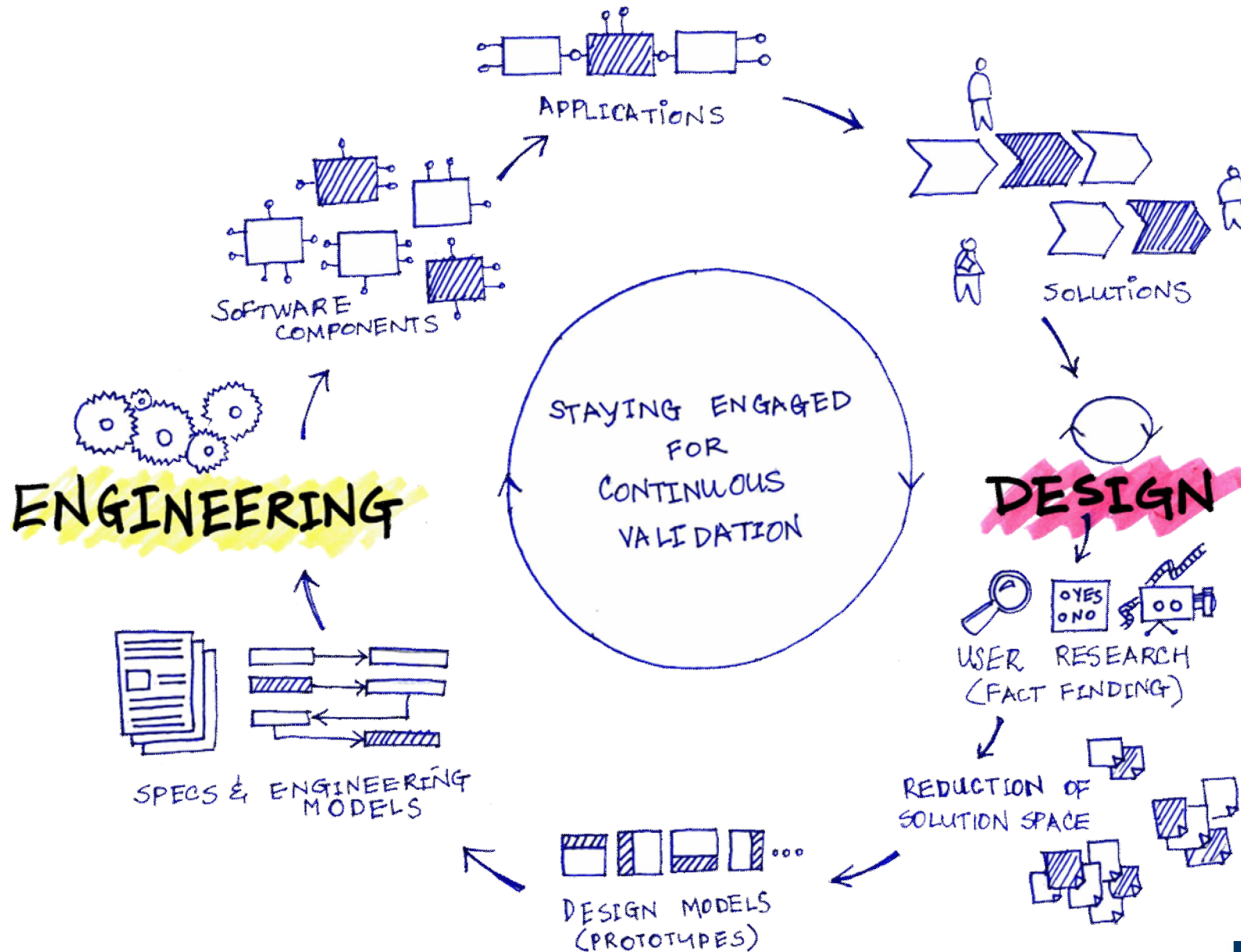
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Who we are ... Introducing Cincom

- Cincom is a Cincinnati based Software and Services company
- I am Lead Consultant for the European Smalltalk services
- Exploratory Modeling evolved from 20 years of Smalltalk experience and our work with SAP over the last 2 years

Who we are ... Introducing BPR Team @ SAP



Who we are ...

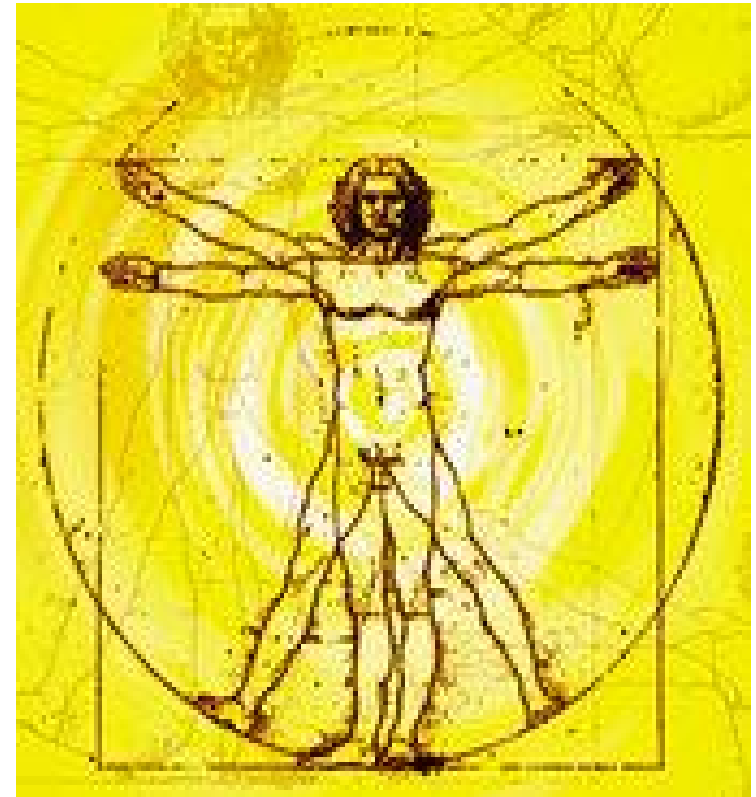
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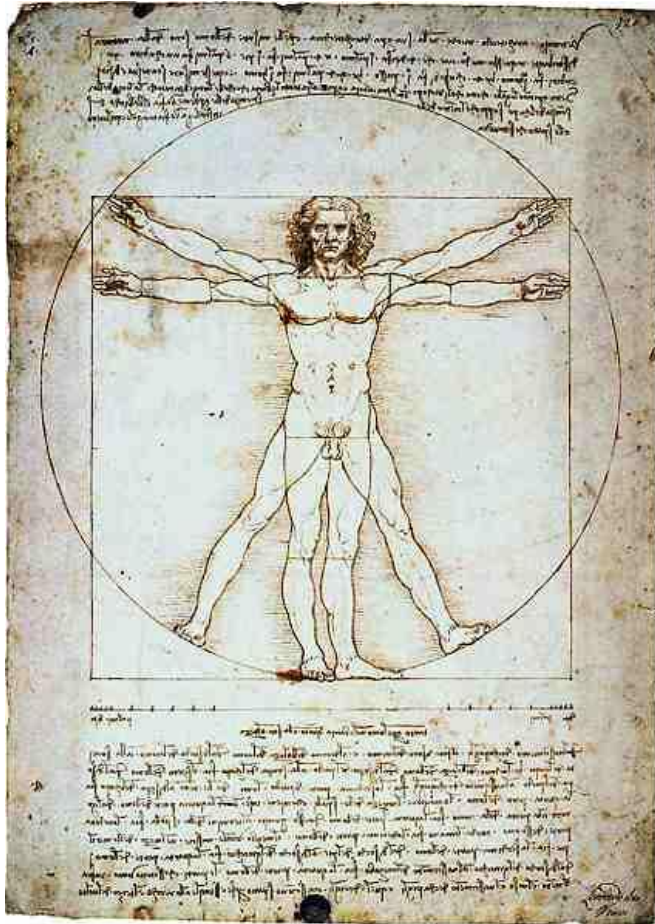


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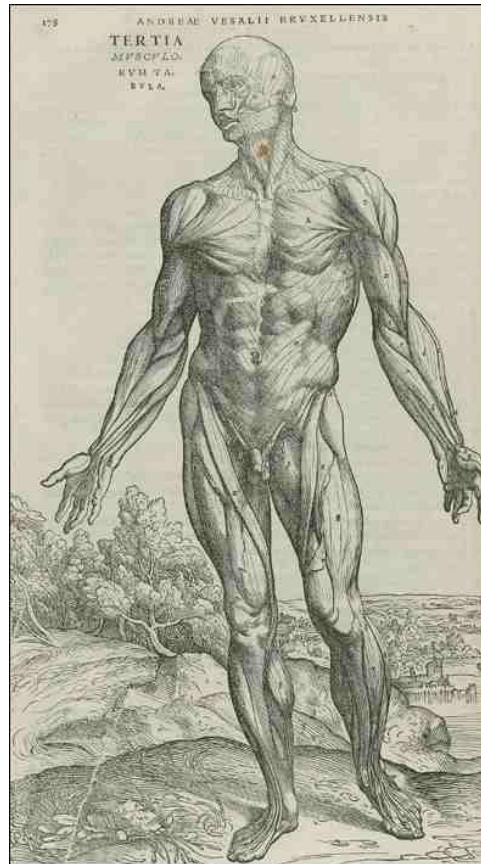
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xM - Exploratory Modeling



De Humani Corporis Fabrica...
Basel, 1543. Woodcut. National Library of Medicine.
Andreas Vesalius
(1514-1564)



Ontleding des menschelyken lichaams...
Amsterdam, 1690. Copperplate engraving with etching. National Library of Medicine.
Portrait of Govard Bidloo (1649-1713) by **Gérard de Lairesse** (1640-1711).

xM - Exploratory Modeling

- This is a story about Communication
- This is about bridging the language gap in Requirements Engineering
- Exploratory Modeling focuses on the hard problems
- It fits in almost every development process
- Results are fast

The Core Pain Point

- Capturing requirements means to establish an understanding between business expert and developer
 - Of business needs
 - Of domain concepts
 - Of developer needs
- This understanding needs to be communicated back for reassurance
- This has some challenges

Challenges – The Unknown

- Requirements are expressed in terms of needs and examples
 - Lack of formal coherence
 - Lack of abstraction
- Understanding the domain
- Moving targets
 - Fixing requirements and understanding changes the goals.

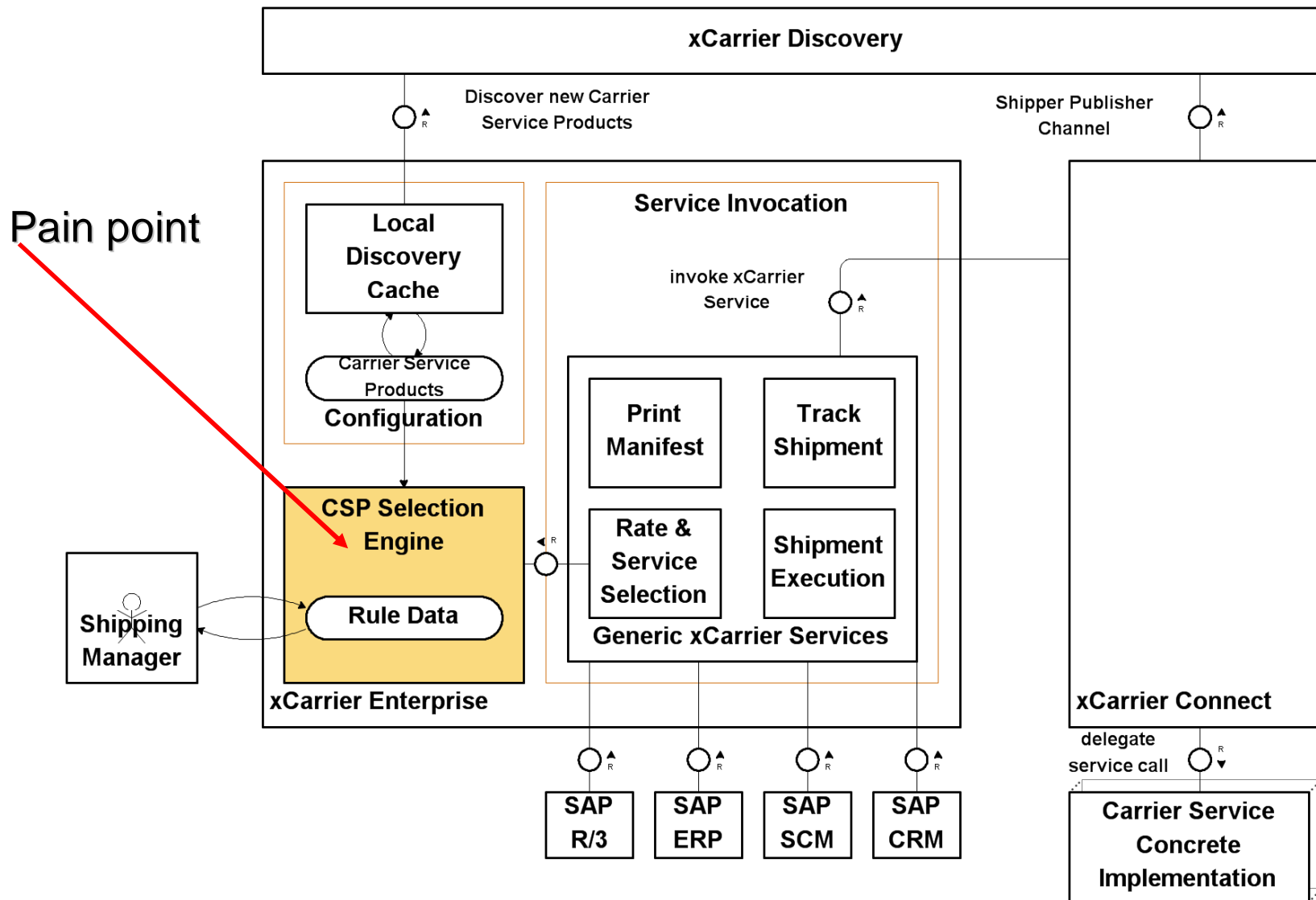
Challenges – The Unspoken

- Language gap!
 - Different approach for describing concepts
 - Developer: formal, abstract, seeking generalizations
 - Expert: more informal, example (process) based, individual use cases
- Need a common language for the domain **and** for talking about the modeling process

Challenges - Consequences

- Missing mutual agreement on the model
 - Captures the expert's requirements
 - Can be handled by the developer
- Why does the business expert agree that a model captures his requirements?
- → See the challenges and consequences faced by SAP

xCarrier Pains



SAP's solution for shipment processing

Used to efficiently schedule Carrier service products against Customers' shipping needs

The goal was to support the shipping manager in the selection of the appropriate carrier, the service product and the service options

To do this we needed a high degree of flexibility in modeling the service products and options

The customers base the rules on very different sets of input data

The Rule Engine is meant to decide for customer which is the right carrier service product to use

- **Rules maintained by Customer, Carrier and Shipper**

- **Inadequate Requirements:**
Customers didn't know exact requirements for a rule engine
- **Re-Use of existing components (rule engines) without exact requirements**
- **Communication Gap**
- **Deficiency of Understanding each other**

- **Requirements were driven by technology but not by the customer!**

- **Not Solved for over a year**
- **Project Stalled - Requirements Paralysis**
- **Frustrated Developers**
- **Dissatisfied Customers**

xCarrier - Why was this so hard?

- No consistent description to define the carrier service products across the industry
- Failure to abstract the selection rules given by business experts
- Requirements were a huge inconsistent spreadsheet of rules collected over a year
- Users could not articulate an abstract model of solving their problems

xCarrier Communication Woes

- Experts (Shipping managers) could not communicate what they wanted



- Development team could not articulate what they heard

- The first could not understand what was fed back to them from the developers



Consequences for SAP

- Missing buy-in of both business experts and developers
 - “This is not what we wanted”
- Loss of trust
- Staledated development

- How can we improve on the communication between business expert and developer?

Current Approaches

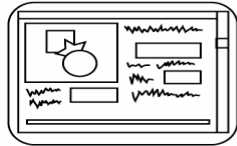
Sketches



Mock-ups



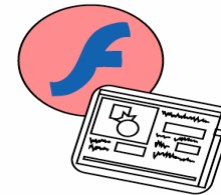
Wire Frames



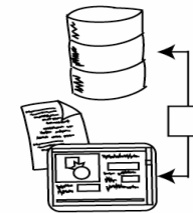
HTML



Flash



Functional Code

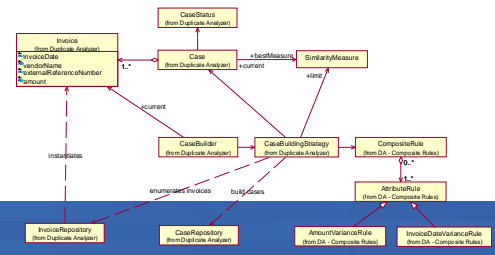
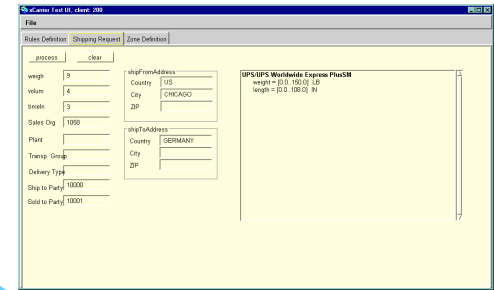
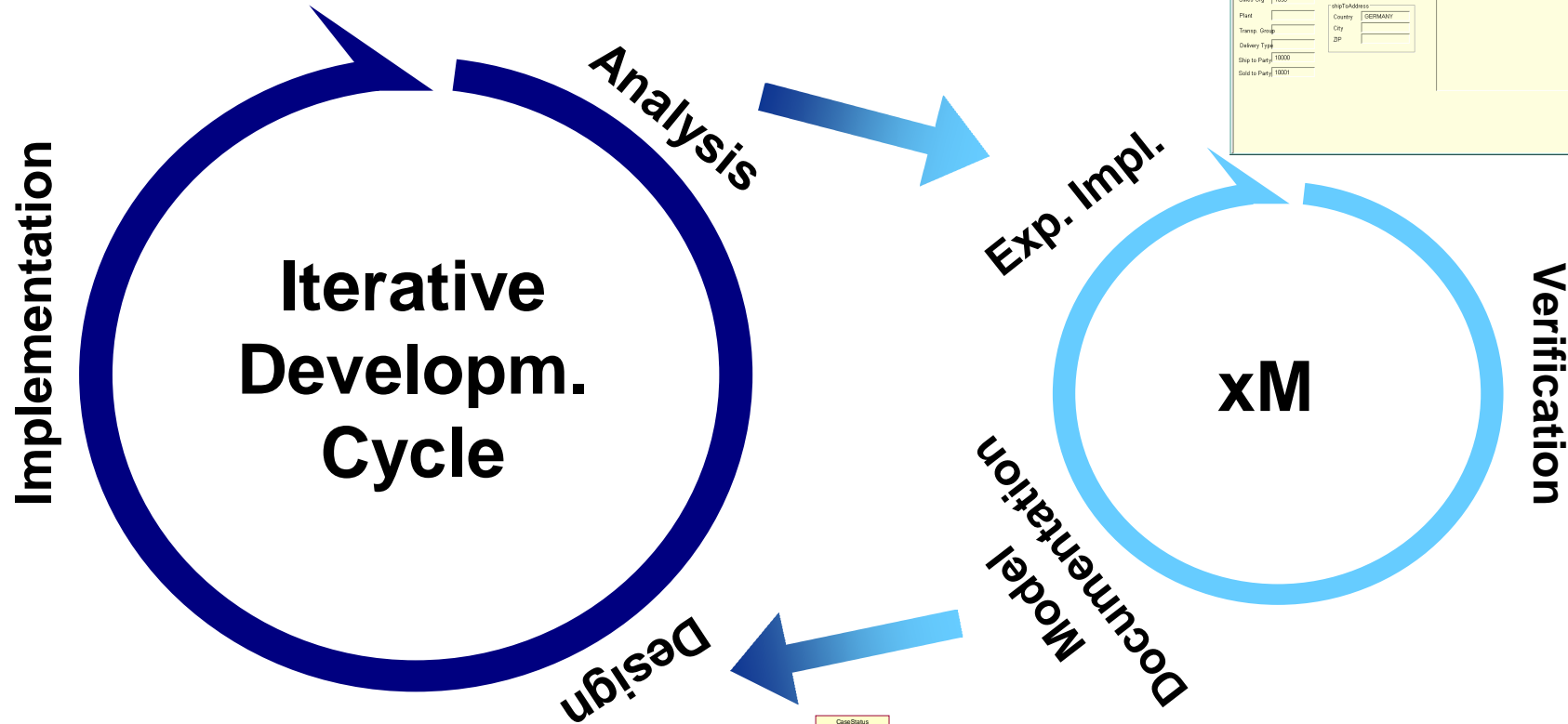


- Target at **expressing** requirements in a specific form and for one group of stakeholder
- Need to combine several to be useful for communication

Objectives of Exploratory Modeling

- Find a modeling process that
 - Expresses the requirements in enough formal rigor
 - Can be understood by the business expert
 - Is fast enough to take place during communication
- Produce an agreeable proof that the model is right to get both parties to buy-in
- Allow to extract requirements documentation from the model

Exploratory Modeling Process



Elements of Exploratory Modeling

1. Runnable model of requirements
 2. Systematic experiments with the model
 3. Extraction of requirements documentation
- Iteration

Runnable Model

- A program that
 - Uses a generic domain specific language
 - Captures the model truthfully
 - Is formal enough to be useful for a developer
 - Is simple enough to be understandable for a business expert
- Not a quick&dirty prototype!
 - “make it run” is not enough
 - Requirements and program terms should be identical

Systematic Experimentation

- The key point of making the model runnable
- Allows stakeholder to experience and visualize their requirements
- Run the model against a life environment
- Show what was good and not so good
- Gives the expert verifiable proof of what the model does

Requirements Extraction

- The output of a xM cycle
- Model implementation instead of prototype
 - Model artifacts stay in sync with documents
 - No translation of model to requirements necessary
- Manual process
- Document form as needed in project

- Runnable model is too technical to serve as the requirement spec

Iterate

- Iterate modeling and experimenting
- Gain better understanding
- Deepen the model

- Often creates major breakthrough in requirements definition

How to get a Runnable Model?

- Use the language of the business expert
- Stay as simple as technically possible
- Avoid “technical” translations from concepts to implementation artifacts
- Don't use fancy frameworks
 - If in doubt, copy&paste makes the model clearer than skillful abstractions
- Make a clear distinction between model and experimentation environment

What do you Need?

- A programming language that can act as a generic domain-specific language
- A programming environment that must be immediate, fluid and dynamic
 - Allows model changes rapidly
- A runtime environment that can place the experiments in life environments

- This is called Smalltalk

And why does it work?

- Special properties of dynamic programming languages and in particular of Cincom Smalltalk
- Allows expressing models almost in natural language
- Very change friendly environment

Where to apply Exploratory Modeling?

- Projects that are critical to customers and where the requirements lie in deep human experience
- Projects that are suffering pain points and that are looking to overcome them
- SOA-Projects where the demands on the depth and broadness of service requirements is key

Who we are ...

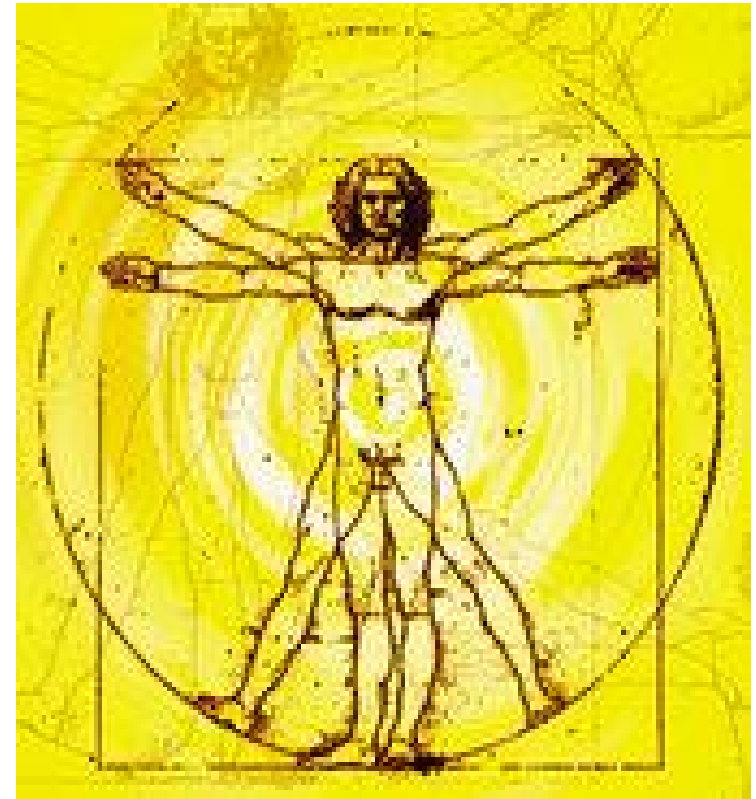
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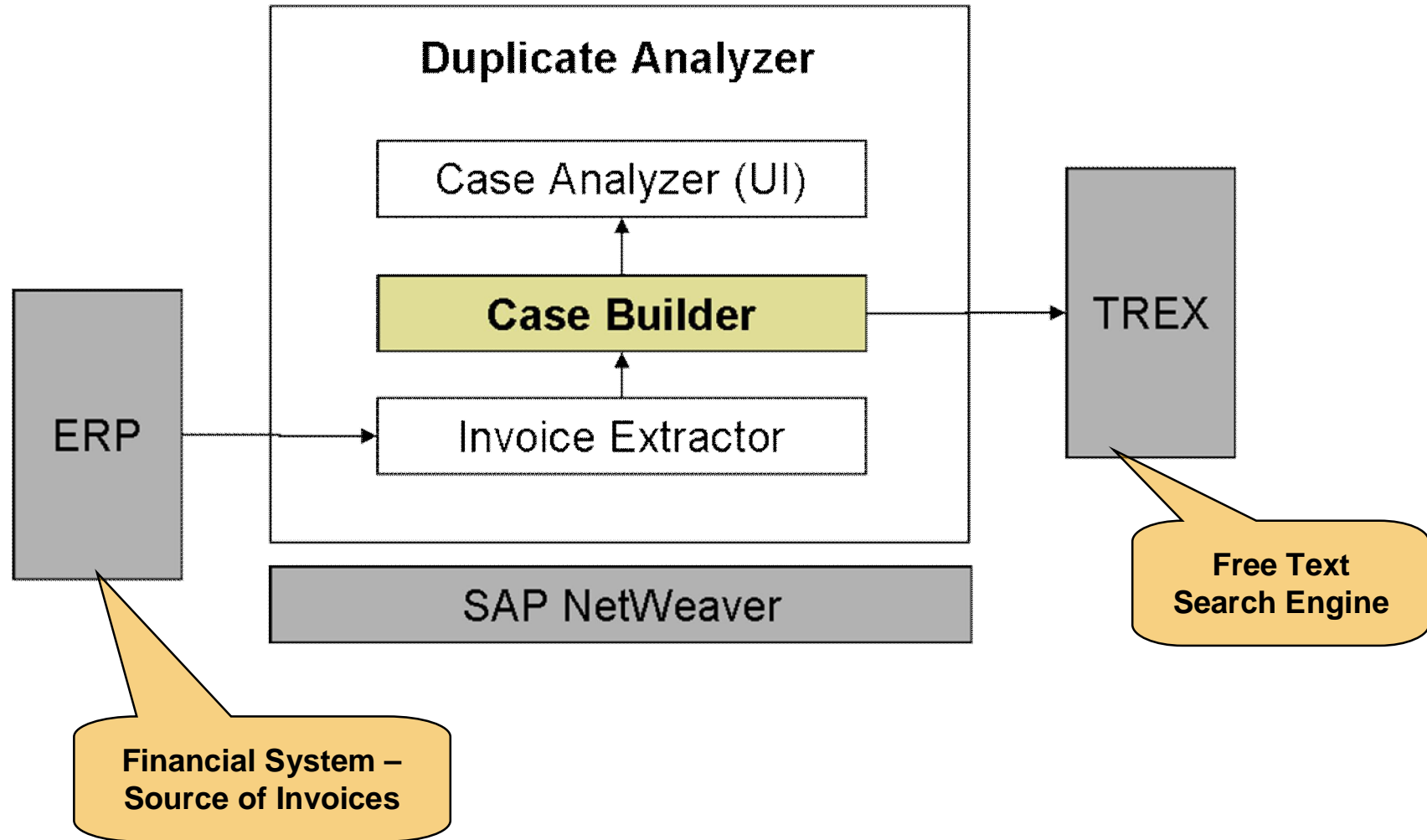


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Duplicate Analyzer – Architectural Overview



Basis is similarity of a set of attributes (invoice number, supplier name, amount, invoice date)

We used our free-text search engine (TREX).

We quickly had a working prototype that analyzed large number of invoices, and identified and ranked possible duplicates: the pilot customers were very happy

BUT:

- **We did not feel that we understood the domain**
- **The A/P clerk was not able to tell us, how he/she recognizes a duplicate**
- **We were not able to change the algorithm.**
- **We got too many „wrong“ duplicates**

Requirements – Fake Interview

- > To start with, what is an invoice and how does it differ from the invoice originals? Can't you always work on the originals?
- <- That would be too time consuming. And the originals are just scans.
- > So what is an invoice and how do you get it?
- <- The invoice is coming from the finance system.
- > What is this invoice?
- <- "shows a dialog of the finance systems"
- > By what criteria do you choose invoices for comparison?
- <- ?
- > You get a list of invoices and do what?
- <- Oh! I suppose I have to compare them one by one. The software should do this.
- > That is the point of this project! So you need to compare all invoices in pairs or do you compare more than two in one go?
- <- No I compare two at a time.
- > Do you compare all invoices with all other invoices?
- <- That takes too much time. I only compare those that are interesting and potentially duplicate.
- > How do you determine these invoice pairs?
- <- ? I look at them and see.
- > So you have some rules by which you know it is worthwhile looking a bit closer?
- <- ?
- > How do you know? How do you pick invoices to compare in the first place?
- <- That is difficult to explain. I use my experience.

How do you model experience?

Demo

Duplicate Analyzer – The Experimental Environment II

The screenshot shows the SAP Duplicate Analyzer window. The title bar reads "Duplicate Analyzer" and the menu bar includes "File", "Running", and "Debugging".

At the top, there are several controls:

- Radio buttons for "All Cases" (unselected) and "All Mature Cases" (selected).
- Text boxes for "Invoices" (10000), "Cases" (11983), and "Mature" (1983).
- A "Runtime:" label followed by a text box containing "52385".
- Radio buttons for "Saved" (unselected) and "Current" (selected).
- Radio buttons for "Only in Saved" (unselected) and "Only in Current" (unselected).

The main area is a list of document keys, each followed by a list of values in parentheses. The key `0001;0052137930;2004` is highlighted in blue. Below it, two indented keys are shown: `0001;0052137930;2004` and `0001;0052139526;2004`.

On the right side, a detailed view for the selected key is shown:

Doc Key: 0001;0052137930;2004
Vendor: 'Stadtwerke Walldorf GmbH'
Reference: '1000529/6002524'
Date: 1. Februar 2003
Amount: 49.0d

Doc Key: 0001;0052139526;2004
Vendor: 'Stadtwerke Walldorf GmbH'
Reference: '1000529/6002524'
Date: 1. März 2003
Amount: 49.0d

At the bottom of the window, a status bar shows "100%".

Duplicate Analyzer – The Experimental Environment I

Duplicate Analyzer Settings

Database Table: 2004 Comp0001

Read Limit: 10000

Rule Type: MaxingCompositeRule

Limits

Vendor Name: 900

Reference Document: 900

Invoice Date: 1000

Amount: 990

Vendor Name | Reference Number | Invoice Date | **Amount**

Percentage

Variance: 10

Number Swapping

Cancel

Accept

Duplicate Analyzer

Duplicate Analyzer

Welcome ASUG user

[Log Off](#) [Send feedback to](#)



Cases Case Details Case Images Case Log Settings



Search Criteria

Amount from:

Amount to:

Posting Date from:

Posting Date to:

Invoice Date from:

Invoice Date to:

Vendor Name:

Acc Doc Id:

Currency:

Invoice Num:

Status:

- New
- Under Review
- Duplicate
- Not a Duplicate
- Duplicate Solved

Duplicate Cases

Click on a case to see the case details

| Id | Invoice Number | Vendor Name | Amount | Curr | Invoice Date | Posting Date | Status | Similarity |
|--------------------------------------|----------------|------------------------|-----------|------|--------------|--------------|--------|------------|
| 0008;0016234527;2005 | 1804 | NEUMAMED CORP. | 6,800.00 | USD | 10/01/2005 | 12/08/2005 | New | ☆☆☆☆☆ |
| 0008;0016235549;2005 | SAPA053E4 | BLUETRANS ASSOCIATION | 431.91 | USD | 10/10/2005 | 12/12/2005 | New | ☆☆☆☆☆ |
| 0008;0016239028;2005 | 2006 | MASTERMED PARTNERS LLC | 90.00 | USD | 12/20/2005 | 12/20/2005 | New | ☆☆☆☆☆ |
| 0008;0016239030;2005 | 2006 | GREENFOOD INC. | 75.00 | USD | 12/20/2005 | 12/20/2005 | New | ☆☆☆☆☆ |
| 0008;0016240258;2005 | 11302005 | FEDFISH COMPANY | 3,300.00 | USD | 11/30/2005 | 12/27/2005 | New | ☆☆☆☆☆ |
| 0008;0016240259;2005 | 11302005 | FEDFISH COMPANY | 2,250.00 | USD | 11/30/2005 | 12/27/2005 | New | ☆☆☆☆☆ |
| 0008;0016240275;2005 | 11302005 | FEDFISH COMPANY | 2,790.00 | USD | 11/30/2005 | 12/27/2005 | New | ☆☆☆☆☆ |
| 0008;0016235445;2005 | 2005 | KILOGROUND BANK | 19,400.00 | USD | 12/12/2005 | 12/15/2005 | New | ☆☆☆☆☆ |

Row 1 of 8

Total Cases: 8 Selected Cases: 8



Duplicate Analyzer

Cases Case Details Case Images Case Log Settings

Details for Case 0008;0016234527;2005 0008;0016237277;2005

Previous Case Next Case

Note: Save to Log Status: New Under Review Duplicate Not a Duplicate Duplicate Solved

0008;0016234527;2005

Invoice Number: 1804 Vendor Num: 0090670192
 Invoice Date: 10/1/2005 Vendor Name: NeumaMed Corp.
 Posting Date: 11/17/2005 Clearing:
 User Id: 1806308
 Description: M.Applebe@Celanese / 090105 - 093005 / 49821

| Item | PO | Description | Quantity | Line Amount |
|------|------------|--|----------|-------------|
| 002 | 5000049821 | M.Applebe@Celanese9/12/5-3/30/06\$85K3 | 80 | 6,800.00 |

Row 1 of 1

Balance Due: 6,800.00 USD

0008;0016237277;2005

Invoice Number: 1804 Vendor Num: 0090670192
 Invoice Date: 10/1/2005 Vendor Name: NeumaMed Corp.
 Posting Date: 12/8/2005 Clearing:
 User Id: 1806308
 Description: M.Applebe@Celanese / 090105 - 093005 / 49821

| Item | PO | Description | Quantity | Line Amount |
|------|------------|--------------------------------------|----------|-------------|
| 002 | 5000049821 | M.Applebe@Celanese9/12/5-3/30/06\$85 | 80 | 6,800.00 |

Row 1 of 1

Balance Due: 6,800.00 USD

Compare Images

Zoom In Zoom Out

Leading Invoice 0008;0016234527;2005

NeumaMed Corp. Invoice

| | |
|------------------|------------|
| Date | 10/1/2005 |
| Invoice # | 1804 |
| P.O./Reference # | 5000049821 |
| Terms | Net 30 |

Bill To: Mo Ghanem
 Coffee Beans Express

RECEIVED NOV 11 2005

| Description | Hours | Rate | Amount |
|---|-------|-------|----------|
| Web Development on Lighthammer Software Implementations performed by Michael Appleby for the period September 01-30, 2005 | | | |
| PROJECT: Celanese Ticona Enhancement | 80 | 85.00 | 6,800.00 |
| Project - Tax Exempt | | 0.00% | 0.00 |

Duplicate 0008;0016237277;2005

NeumaMed Corp. Invoice

| | |
|------------------|------------|
| Date | 10/1/2005 |
| Invoice # | 1804 |
| P.O./Reference # | 5000049821 |
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Communication/Common Understanding

- Got a much better understanding of the domain
- Closed the communication gap with the A/P clerks and...
- ...learned to „think as“ an A/P clerk!

Technical Results

- Got a much more flexible solution
- Added and tested new algorithms
- Improved run-time behavior

Business Results

- Found new Duplicates
- Identified a new process gap causing duplicates

Project Results

- Finished in 7 days!

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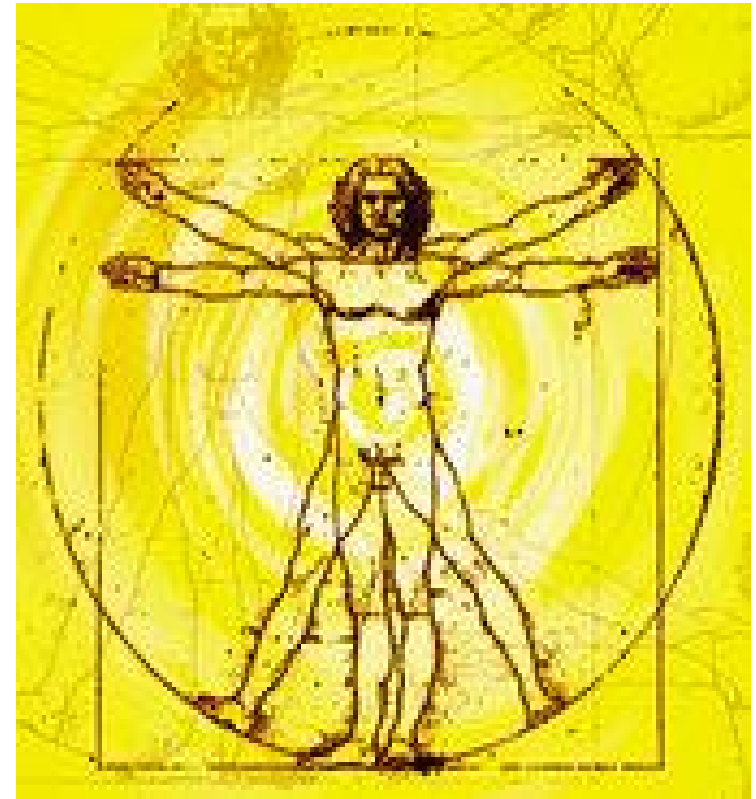
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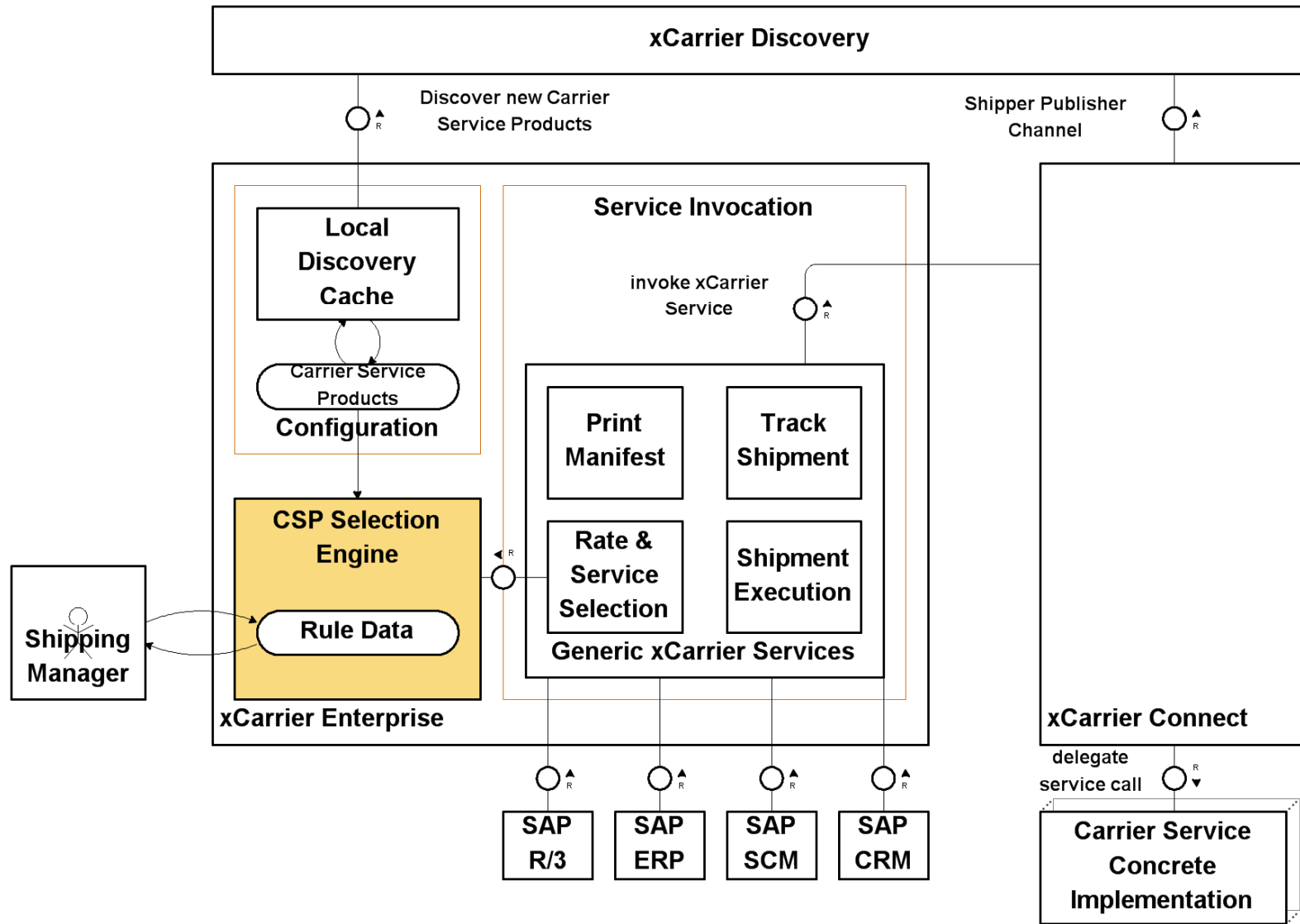


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xCarrier Pains



xCarrier – The Real World Application

Welcome, Shipping Manager

xCarrier

Overview

Shipments

Setup

Reports

Exceptions & Work Items

Alerts(1)

Notifications(4)

Tasks(1)

Escalations(7)


My Carriers



US Express shipping volumes gone up 30% over the past three month.
US Ground shipping volumes gone up 10% over the past month.


Updates are available for: rates, routing codes, labeling.

Contact: Jack Monroe
License: 948572903
[More Details...](#)



C.O.D is now available when shipping to Israel.


Contact: Keith Adams
License: 432313459
[More Details...](#)



C.O.D is now available when shipping to Israel.

Contact: Chris Roberts
License: 523234536
[More Details...](#)

Other xCarrier Providers



TNT provides businesses and consumers worldwide with an extensive range of services for their mail and express delivery needs.
TNT serves more than 200 countries.

[More Details...](#)

US Shipping Volumes

Report for FedEx [Full Report](#)

| Region/Service Type | Oct '05 | | 3 Month Range | |
|--------------------------|-----------------|-----------------|-----------------|----------------------|
| | Shipments | Freight Charges | Shipments | Freight Charges |
| ▼ East Coast | | | | |
| FedEx Priority Overnight | 15800 (+32%) | \$79000 | 12000 - 15800 | \$60000 - \$79000 |
| FedEx Standard Overnight | 105130 (+0.05%) | \$210260 | 105000 - 105130 | \$210,000 - \$210260 |
| ▼ West Coast | | | | |
| FedEx Priority Overnight | 1580 (+31%) | \$7900 | 1200 - 1580 | \$6000 - \$7900 |
| FedEx Standard Overnight | 10130 (+0.04%) | \$20260 | 10000 - 10130 | \$20000 - \$20260 |
| ▼ Totals | | | | |
| FedEx Priority Overnight | 17380 | \$86900 | 13200 - 17380 | \$66000 - \$86900 |
| FedEx Standard Overnight | 115,260 | \$230520 | 115000 - 115260 | \$230000 - \$230520 |

Coffee Beans Express News

Click on any headline for a complete story:

- [Agribusiness exports up 8.8 percent](#)
BIS Oct 9th, 2005, 21:28 - Length: 806
- [Agribusiness exports up 8.8 percent](#)
BIS Oct 9th, 2005, 21:26 - Length: 806
- [Aust taps into Japan's discovery of coffee](#)
ABX Oct 9th, 2005, 18:53 - Length: 969
- [Add sugar and stir: Aussies hope to milk Japan's coffee boom](#)
ABX Oct 9th, 2005, 18:39 - Length: 969
- [Twenty-four percent of coffee drunk by Colombians is imported](#)
EFE Oct 9th, 2005, 16:36 - Length: 2325
- [NA-FIN--US-Coffee](#)
AWS Oct 7th, 2005, 15:21 - Length: 698
- [NA-FIN--US-Coffee](#)

For carrier, service product and service option selection we implemented a rule engine prototype in Smalltalk (in about 1 week)

After two weeks we were able to verify the scope of rules at customer sites

The rule maintenance was done in Java WebDynpro front-end, and the resulting rules were persisted in the Smalltalk component.

The integration to the NetWeaver stack was done via Web services.

xCarrier – The Experimental Environment I

xCarrier Test UI, client: 200

File

Rules Definition | Shipping Request | Zone Definition

```

IF #weight is less 2.0 LB THEN USE UPS / UPS Next Day Air
IF #volume is greater 1000 L AND #shipFromAddress is less e
IF #weight is less 10.0 LB THEN USE UPS / UPS 2nd Day Air
IF #nco1 is equal 'CIF' AND #weight is less 10.0 LB THEN U
IF #weight is less 10.0 LB THEN USE UPS / UPS 2nd Day Air
IF #deliveryPriority is equal '1' AND #nco1 is equal '0030' AND
IF #weight is less 25 KG AND #timeInTransit is less equal 10
IF #timeInTransit is less equal 5 TAG AND #weight is less equ
IF #weight is less equal 10 KG AND #timeInTransit is less
IF #nco1 is equal 'ABC' AND #weight is less equal 10 KG AN
IF #salesOrg is equal '0010' AND #weight is less equal 10.0
IF #salesOrg is equal '0010' THEN USE UPS / UPS Ground
IF #salesOrg is equal '0010' AND #weight is less equal 10 KG
    
```

Create Delete Modify Clear

IF #weight is less equal 10 KG AND #timeInTransit is less equal 5 TAG AND #shipToAddress

2UQ73ICK8PP Express Shipping to Europe

Rule Attributes

Rule Pri: Medium Valid From: 9/20/06 Valid To: 9/20/08

ShipFrom: ShipTo: EUROPE GERMANY

Rule Conditions

| | | | |
|---------------|---------------|---------|-----|
| weight | is less equal | 10 | KG |
| timeInTransit | is less equal | 5 | TAG |
| shipToAddress | is equal | GERMANY | |
| | | | |
| | | | |

Rule Action

activate use carrier: UPS product: UPS World option:

xCarrier – The Experimental Environment II

xCarrier Test UI, client: 200

File

Rules Definition | **Shipping Request** | Zone Definition

process clear

| | | | | |
|---------------|------------------------------------|-----------------|--------------------------------------|---|
| weigh | <input type="text" value="9"/> | shipFromAddress | | UPS/UPS Worldwide Express PlusSM weight = [0.0..150.0] LB length = [0.0..108.0] IN |
| volum | <input type="text" value="4"/> | Country | <input type="text" value="US"/> | |
| timeln | <input type="text" value="3"/> | City | <input type="text" value="CHICAGO"/> | |
| Sales Org | <input type="text" value="1058"/> | ZIP | <input type="text"/> | |
| Plant | <input type="text"/> | shipToAddress | | |
| Transp. Group | <input type="text"/> | Country | <input type="text" value="GERMANY"/> | |
| Delivery Type | <input type="text"/> | City | <input type="text"/> | |
| Ship to Party | <input type="text" value="10000"/> | ZIP | <input type="text"/> | |
| Sold to Party | <input type="text" value="10001"/> | | | |
| | | | | |

xCarrier – The Real World Application II

Welcome, Shipping Manager

xCarrier

Define a Rule for Carrier & Service Selection

Description:

Valid from: to:

Active

Shipment Conditions

Ship from:

Ship to:

Conditions:

[Add Another Condition](#)

Shipping Method

Carrier and Service:

Shipping Options: Options list is not available

| id from | Valid to | Ship from | Ship to | Active |
|---------|-----------|--------------------------|------------------------|-------------------------------------|
| | | Any location | Any location | <input checked="" type="checkbox"/> |
| /2006 | 7/31/2006 | South America, | North America, Mexico | <input type="checkbox"/> |
| /2006 | 9/30/2006 | Any location | Any location | <input type="checkbox"/> |
| /2006 | 9/30/2006 | Any location | Any location | <input type="checkbox"/> |
| /2006 | 9/30/2006 | Any location | Any location | <input type="checkbox"/> |
| /2006 | 9/30/2006 | South America, Argentina | South America, Bolivia | <input type="checkbox"/> |
| 3/2006 | 9/29/2006 | Africa, South Africa | Europe, Austria | <input type="checkbox"/> |
| 0/2006 | 9/20/2007 | Any location | Europe, | <input type="checkbox"/> |
| 0/2006 | 9/20/2008 | Any location | EUROPE, GERMANY | <input checked="" type="checkbox"/> |
| | | Asia, Singapore | Asia, | <input checked="" type="checkbox"/> |
| | | Any location | Any location | <input checked="" type="checkbox"/> |
| | | Asia, India | Asia, India | <input checked="" type="checkbox"/> |
| | | Asia, India | Asia, | <input checked="" type="checkbox"/> |

By Sales Organization and Weight UPS Express Saver

Communication/Common Understanding

- **Were able to verify requirements on customer site**
- **Got much more precise requirements for rule engine**

Technical Results

- **Were able to choose appropriate rule engine**

Business Results

- **Our pilot customers got what they wanted – although they were not aware what they really needed!!!!**

Project Results

- **First verification cycle with customers after 10 days!**
- **No major changes in rule engine during pilot phase**

Who we are ...

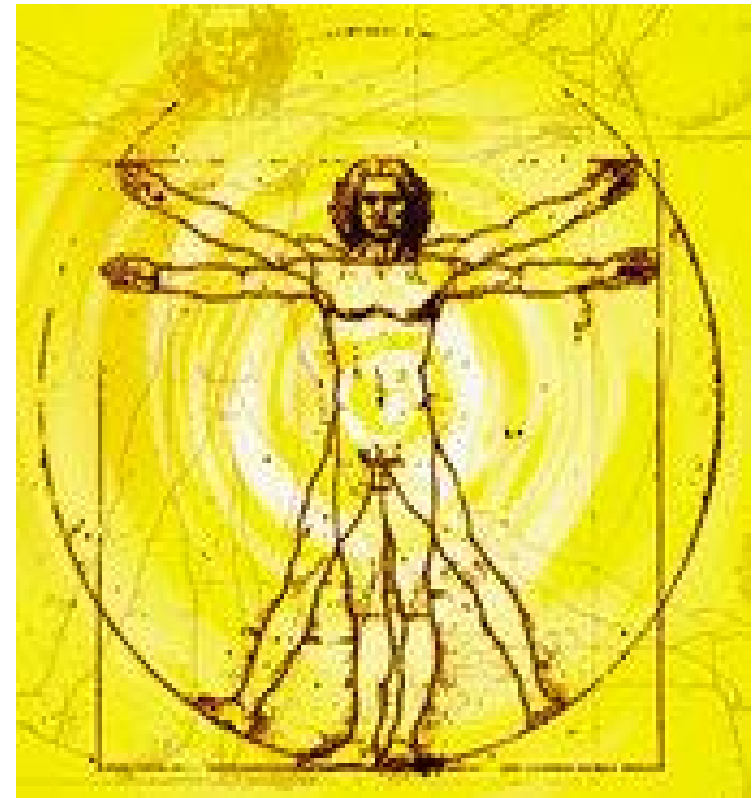
How to do xM ...

How xM works ...

Duplicate Analyzer –
An A/P Clerk Solution

xCarrier –
A Shipping Manager Solution

Summary



SIMPLIFICATION THROUGH INNOVATION™

THE BEST-RUN BUSINESSES RUN SAP™ 

 Cincom®

Explorative research and modeling of domain knowledge

Discovering (and testing) heuristics

Rule systems

It enables fast customer feedback

It supports executable case studies

Conclusions

- Solves hard requirements engineering problems
- Enables or amplifies the communication between expert and developer by
 - Providing a formal basis
 - Creating a common understanding of requirements
 - Proving that the understood requirements do what they should do
- Uses
 - Modeling by programming in a generic domain specific language
 - Continuous experimentation
 - Project-specific requirements documents from model programs

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