

Lecture TU Darmstadt  
Dr. Vladimir Rubin, 22.06.2015



TECHNISCHE  
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DARMSTADT



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## Dr. Vladimir Rubin



- M.Sc. in Computer Science at Moscow State University of Railway Transport
- PhD in Computer Science at the University of Paderborn (International Graduate School), Department Software Engineering
- ~ 3 Years Netcracker Technologies Corp, USA
- ~ 3 Years Capgemini sd&m, Frankfurt/M.
- > 3 Years msg systems ag, Frankfurt/M.
- Today: Independent IT Architekt and Consultant, collaboration with msg systems, Frankfurt, Germany
- Points of interest:
  - Methodical SW-Development and IT-Architecture
  - Process Mining and Data Science
  - Model-driven Software Development (MDD)

## Private

- 33 years old, married, one child
- Hobbies: Music, Yoga, Badminton, Volleyball, Traveling, ...

# Software Projects – too much Technology

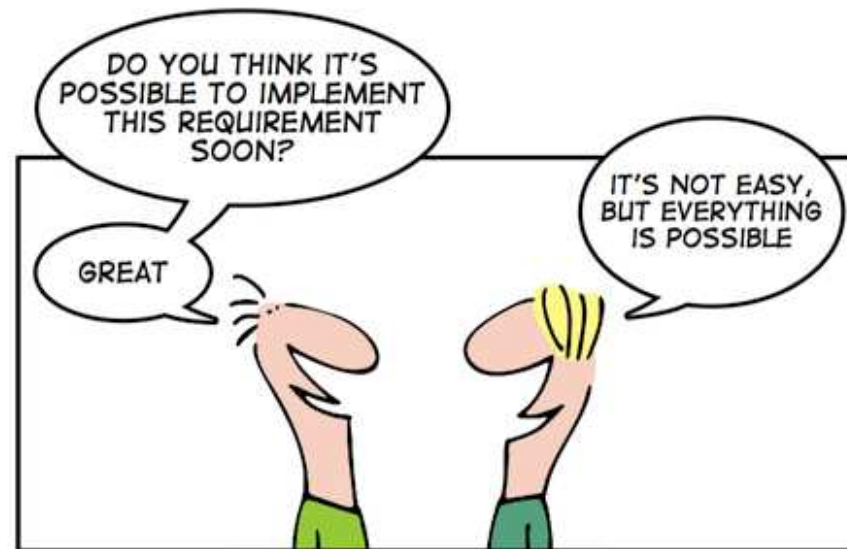


The business logic is getting lost on the way from HTTP to JDBC!

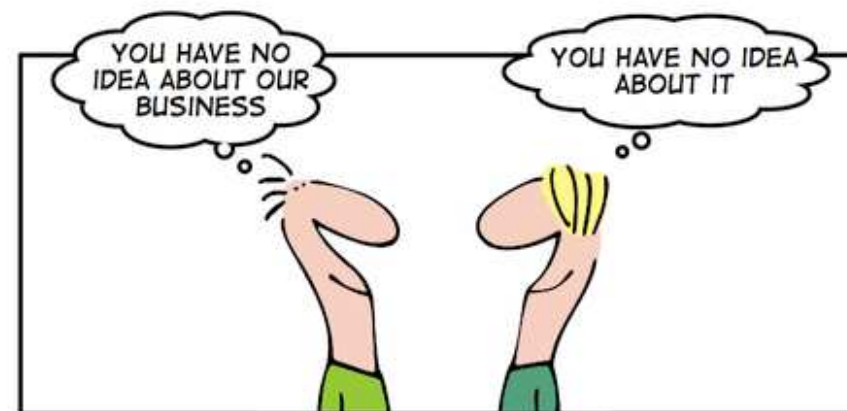
IT People should concentrate on the important things – on the **Business Domain.**

This is what customer needs!

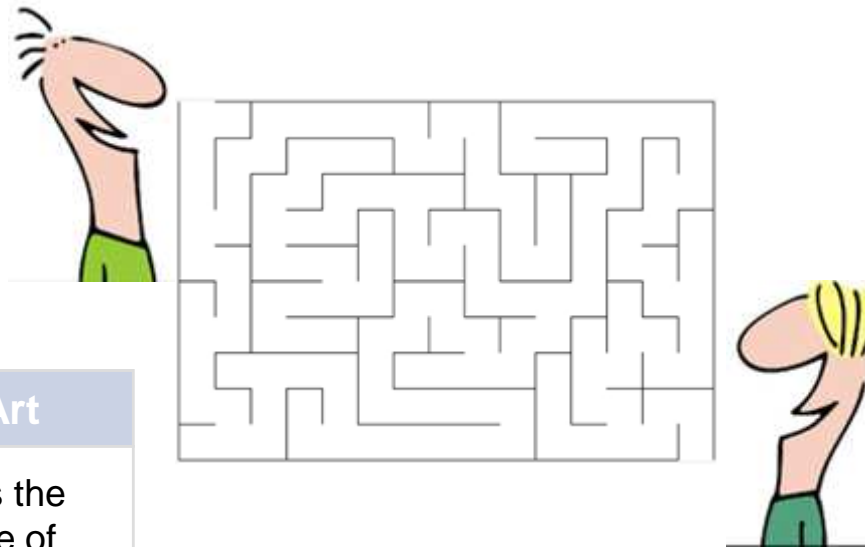
# Business und IT: Challenges (I)



*IT'S REALLY REALLY IMPORTANT THAT BUSINESS AND IT...*



*... TALK TOGETHER*



## Business – State of the Art

Extreme business-cycle volatility is the norm in today's economy. The pace of **business change** has been accelerating over the past few years. There is no way to insure a business against change, except to **change the business constantly**.

## IT - State of the Art

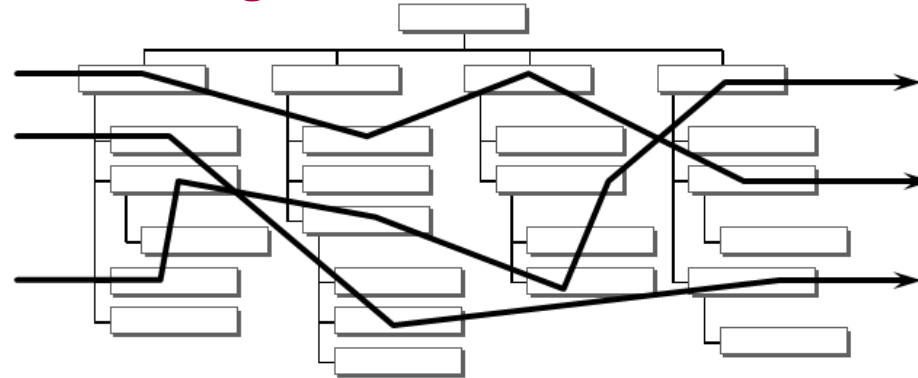
1. System change implementation (**agility**) is not increased while hardware power is increased 10000 times.
2. Business People are frustrated by **IT complexity**, time and costs.
3. There are simply too many steps from wanting smth. to automating it.
4. There is much **too much technology**, so that even IT people do not manage dealing with it.
5. There is not enough structure in the **business requirements** in order to implement them properly.

## Paradigm shift : from Data

before the start of 90s:

- **Data modeling is in focus** (ER-Diagrams, Class Diagrams, OOA/OOD, ... )
- The business logic and the flow of activities is hidden in the source code
- Short-term process changes are almost impossible

## Organizational Processes



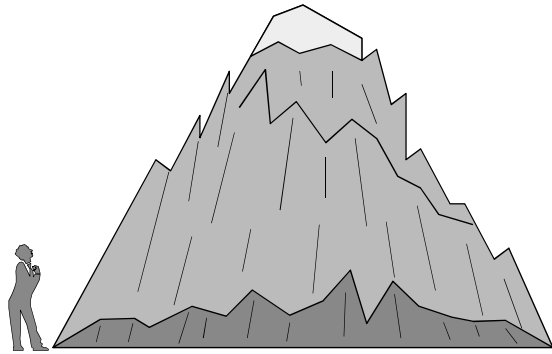
## ... to Processes

from the middle of 90s:

- **Process modeling** becomes more important
- QA (ISO 9000) implies documentation of the processes
- TQM (Total Quality Management) Approach („doing it right the first time“, „eliminate waste“)
- SOA (Service-Oriented Architecture) takes BPM as a foundation
- Short-term process change is essential (flexibility)



# Business + Process = Business Process Management



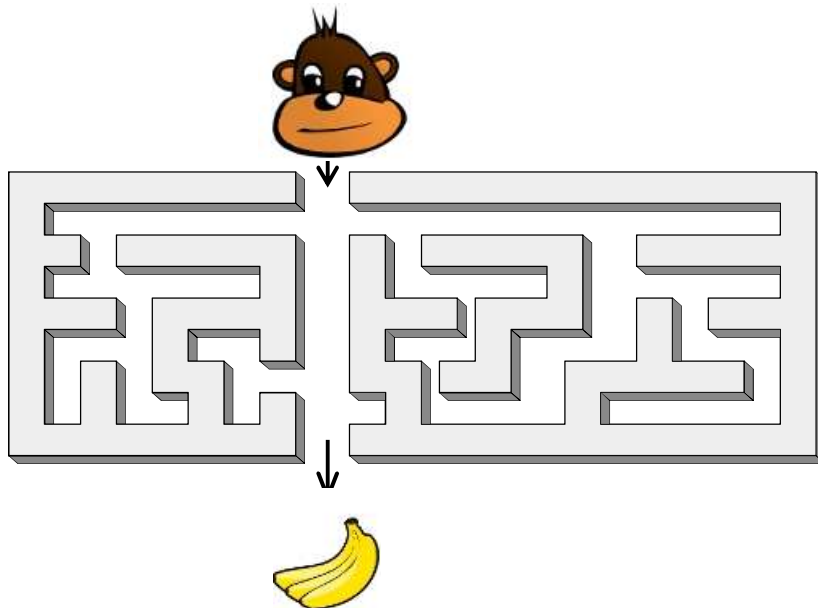
, but

Working in the same business conditions – **some companies continue to thrive** while others get caught in the tsunami wave of business change and struggle for survival.

What differentiates them is the way these companies get the job done - that is the called the **business process**.

(\* <http://www.bpm.com> )

## BPM Area proposes BPMS ( Business Process Management Systems / Suites )



- Describe business objective in the same language the computer needs to automate it
- Automatically guiding the stuff through the process
- Create documentation anytime, not upfront
- Business and IT work in parallel, continuous changes
- Bridges the gaps between Requirements, Specifications and Code
- Focus is not just on code generation, but on a process to guide you and allow you build for change

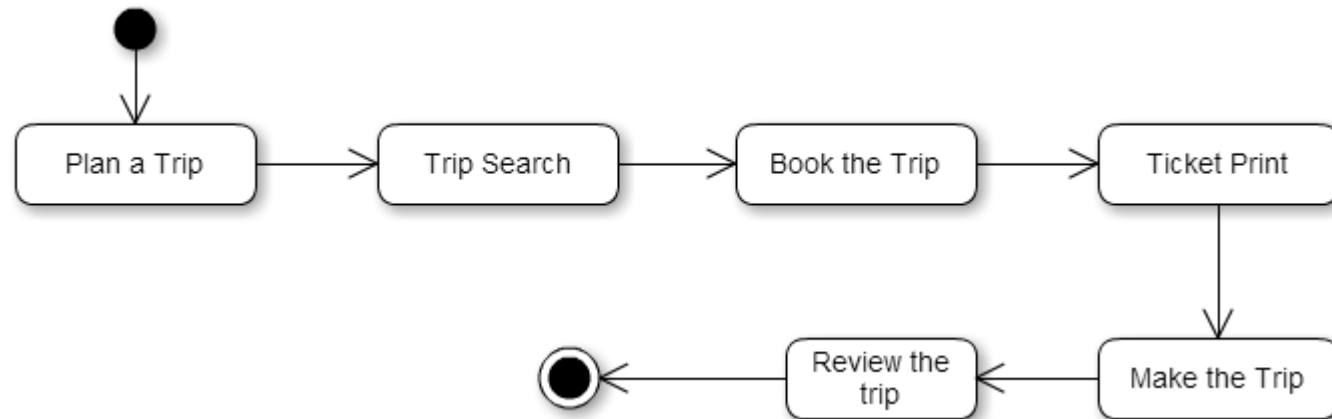
# AGENDA

## 1. BPM Background

- 2. Business Process Modeling
- 3. Industrial BPM Systems
- 4. BPM Best Practices
- 5. Trends



## Business Process

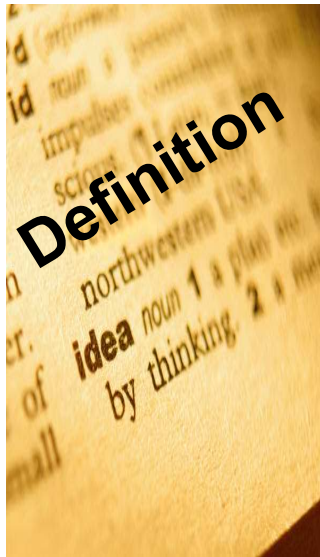


Plan a Trip

Trip Search

Book the Trip

## Activities



## Business Process

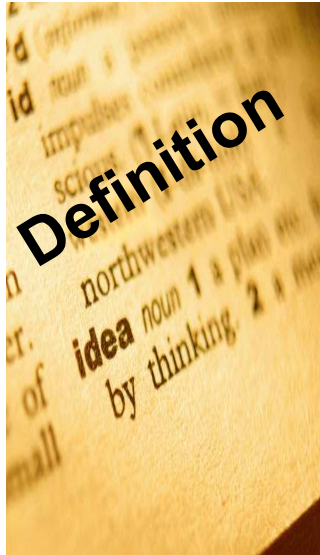
A **business process** consists of a collection of *activities* that are executed in some enterprise or administration according to certain rules and with respect to certain goals.

## Workflow

A **Workflow** is the realization of a business process by some information system.

## Activity

An **activity** / **task** of a business process is an atomic work step that, on the given level of abstraction, cannot be split into more detailed steps.



## Business Process Management

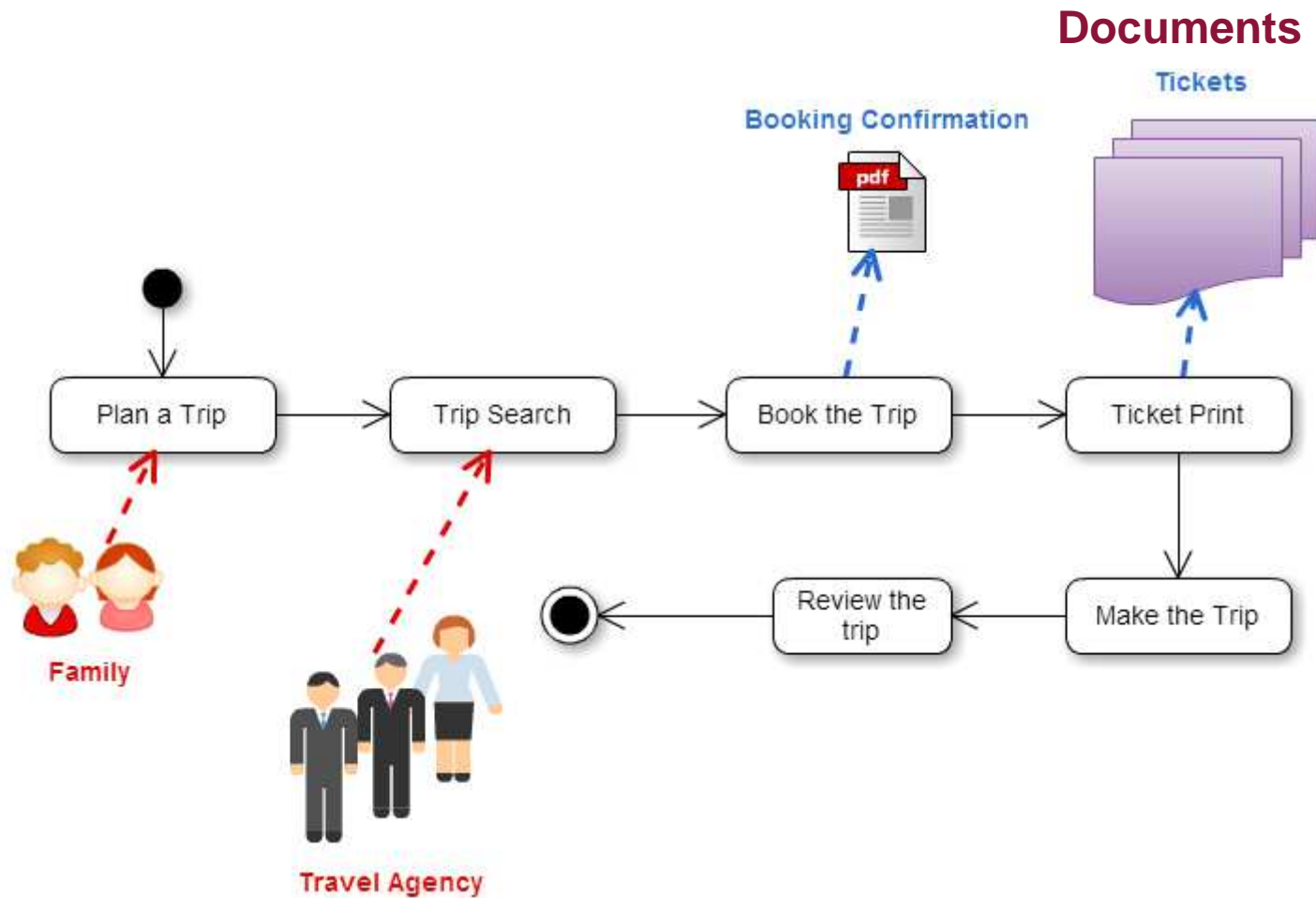
**Business Process Management** is a discipline, which deals with discovery, organization, documentation and improvement of business processes.

Business Process Management synchronizes such business areas as Planning, Design, Construction, Production, Maintenance, Tracking, and Adjustment in an organization.

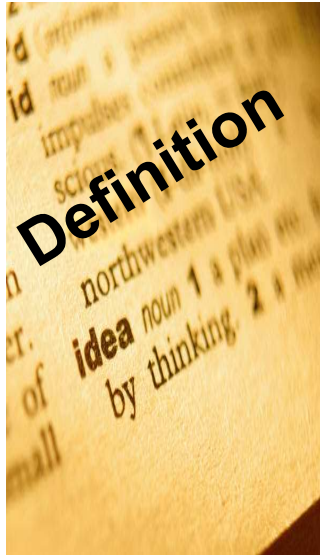
## Information System

**Information system:** A system for storing, retrieving, combining and evaluating information.

[Duden „Informatik“]



## Resources



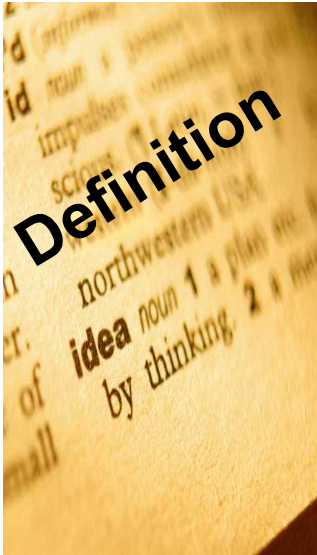
## Document (Informational aspect)

In a business process, **documents** are created, used, and changed. These documents help to exchange information among different activities of the same business process and among different business processes.

## Resources (Organisational Aspect)

A **resource** is a means necessary for executing an activity.

When the resource is a person, we call the resource an **agent**.



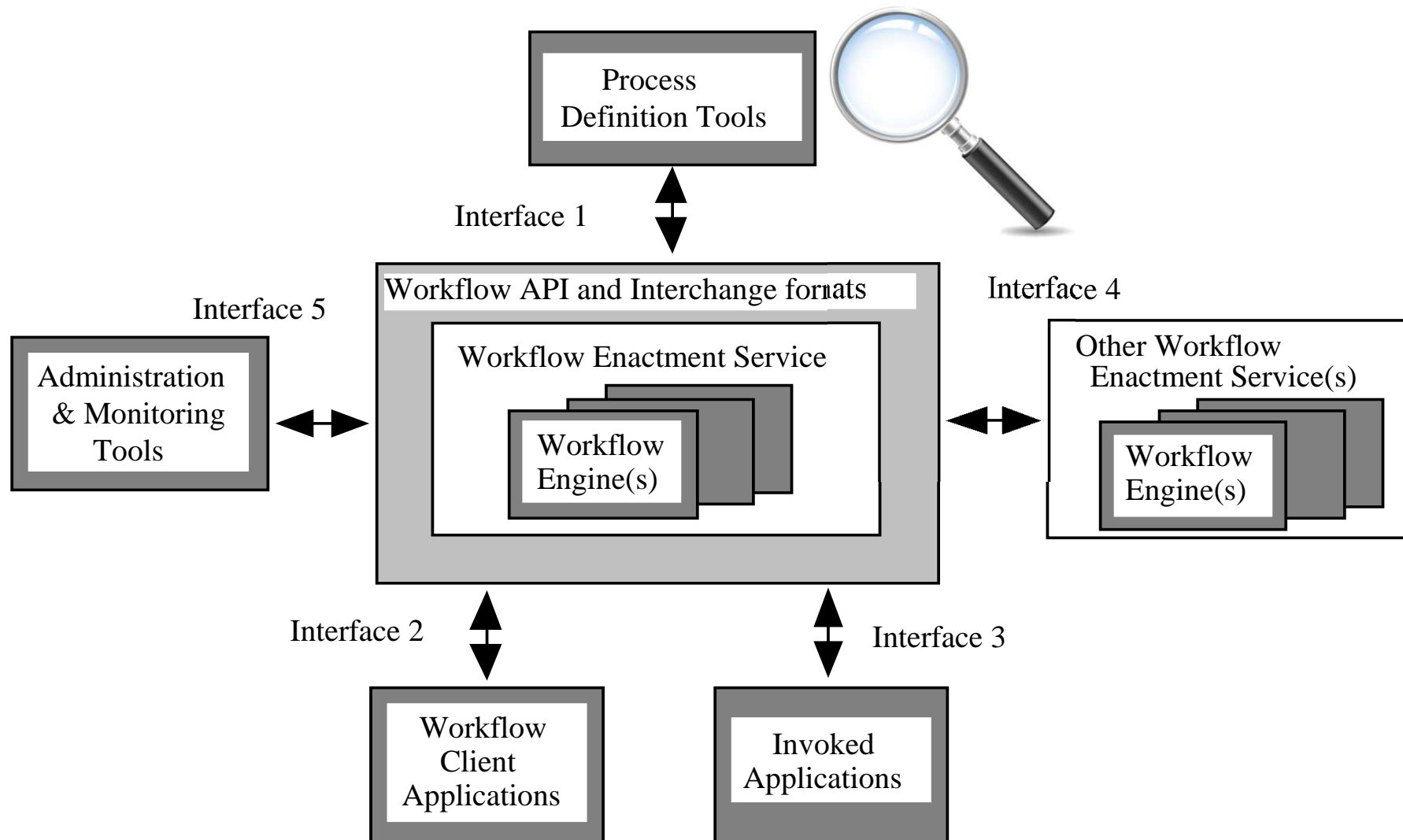
## Workflow Management System (WfMS)

**Workflow Management System** is an information system for the

- **development,**
- **planning,**
- **control, execution, and monitoring,**
- **documentation and**
- **evaluation**

of workflows (business processes).

# Reference Architecture of WfMS





# AGENDA

1. BPM Grundlagen
- 2. Business Process Modeling**
3. Industrial BPM Systeme
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## Business Process Model

- Representation of a business process in a standardized notation. A model is a network of activities and their relations (control flow). Activities can contain information about associated data, business services and resources.

Process model is a representation of process used for its

**analysis,**

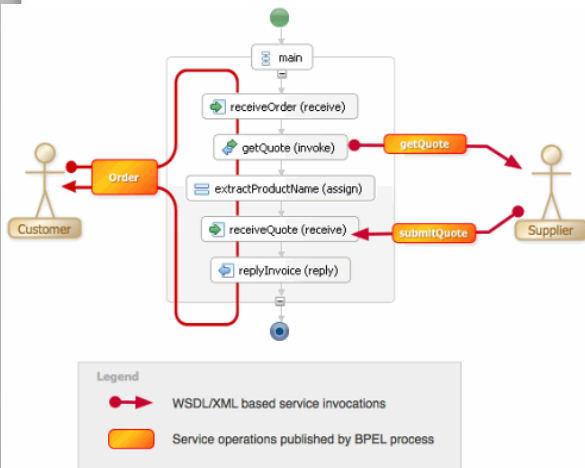
**optimization,**

and **automation**

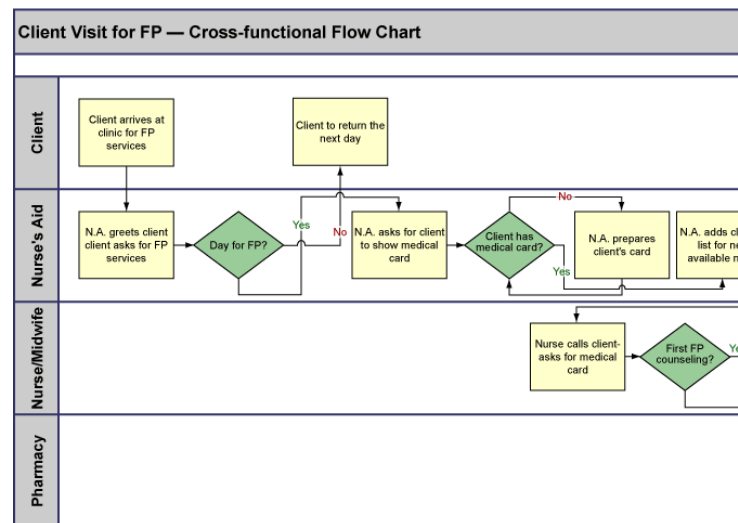
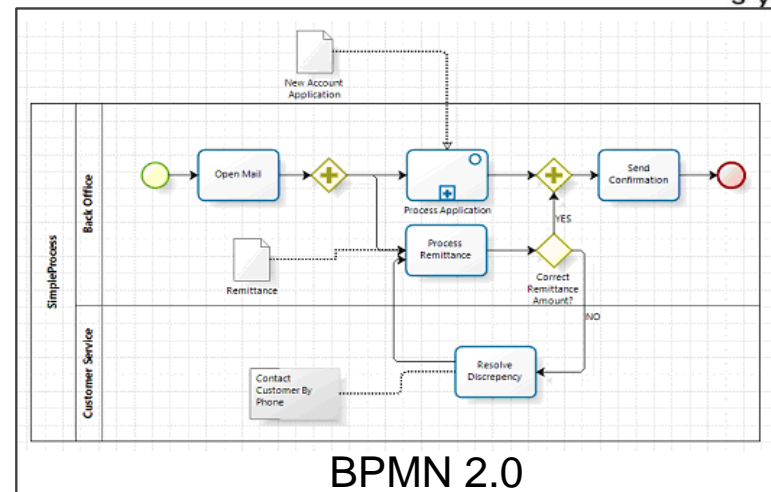


- Business Modeling
  - Business experts and analysts model processes in order to illustrate
    - who is doing what?
    - who needs what?
    - who communicates with whom?
    - where the data flows?
    - where is the standard flow and where are the exceptions?
    - where is the critical path?
- Technical Modeling
  - The goal is the automation and the process and its support by IT
  - Extensions of business processes with technical details
  - The processes are executable by the process engine

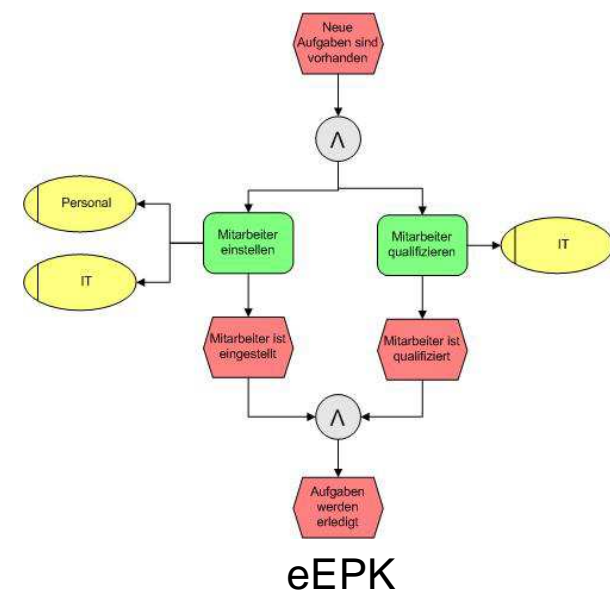
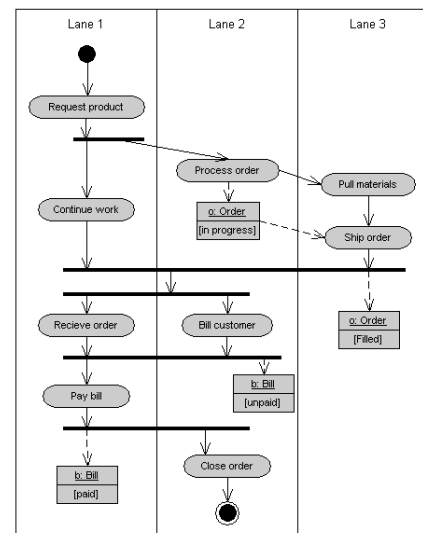
## Different modeling languages

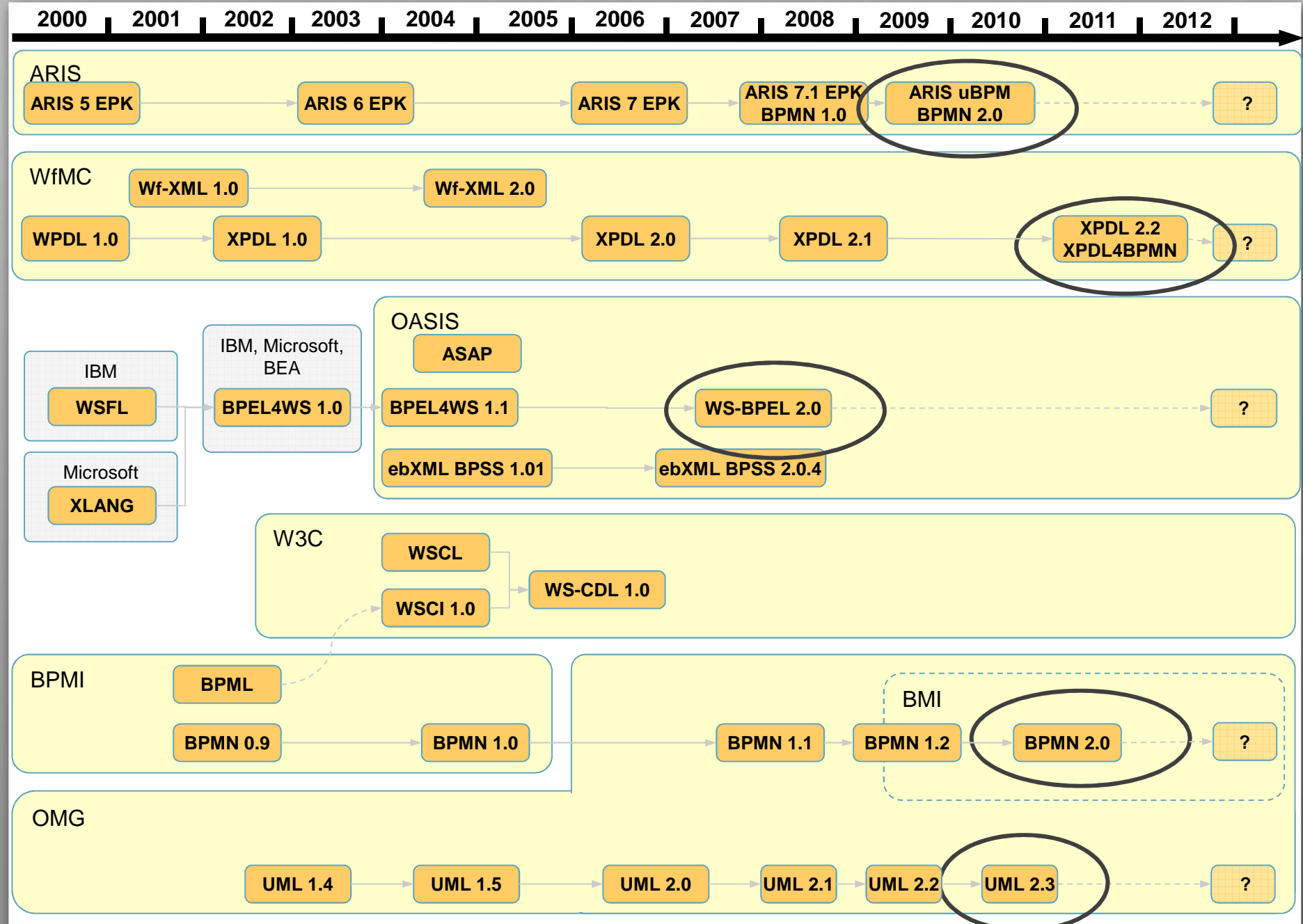


BPEL



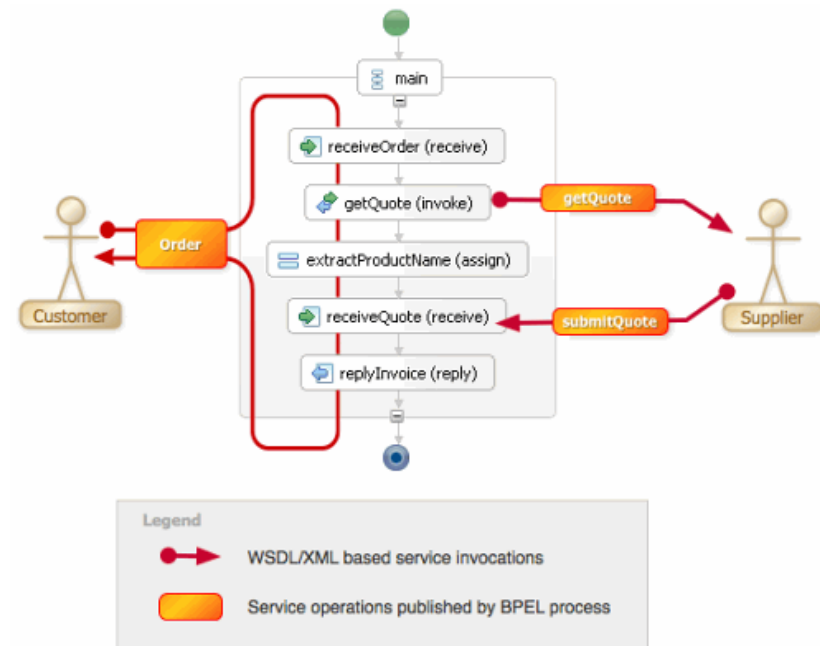
Flow Chart



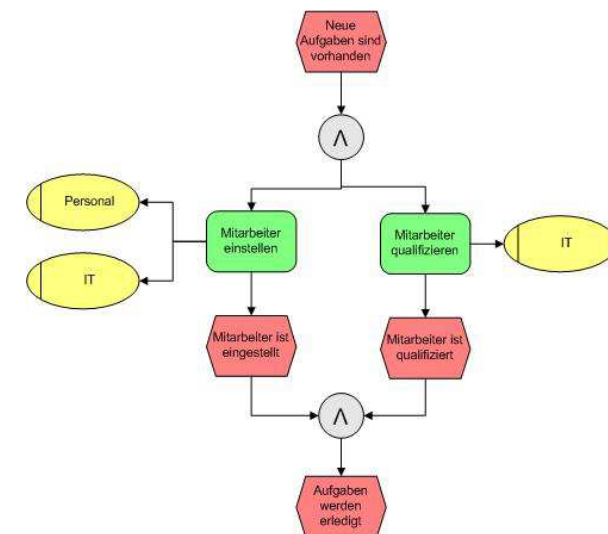


## BPEL (Business Process Execution Language)

- Supports web services
- Is not understandable by business people
- No graphical notation
- BPMN 1.X was mapped to BPEL in order to execute it



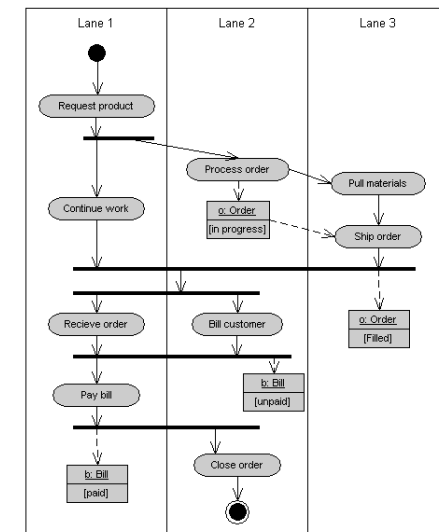
- EPCs were used by SAP for documenting processes
- EPCs can be transformed to BPMN 2.0
- Comparison to BPMN
  - No separation between data and event flows.
  - Start, End and other events can no be distinguished.
  - No event types (e.g. time, message).
  - Can not be executed by the process engine





## UML – Activity Diagrams

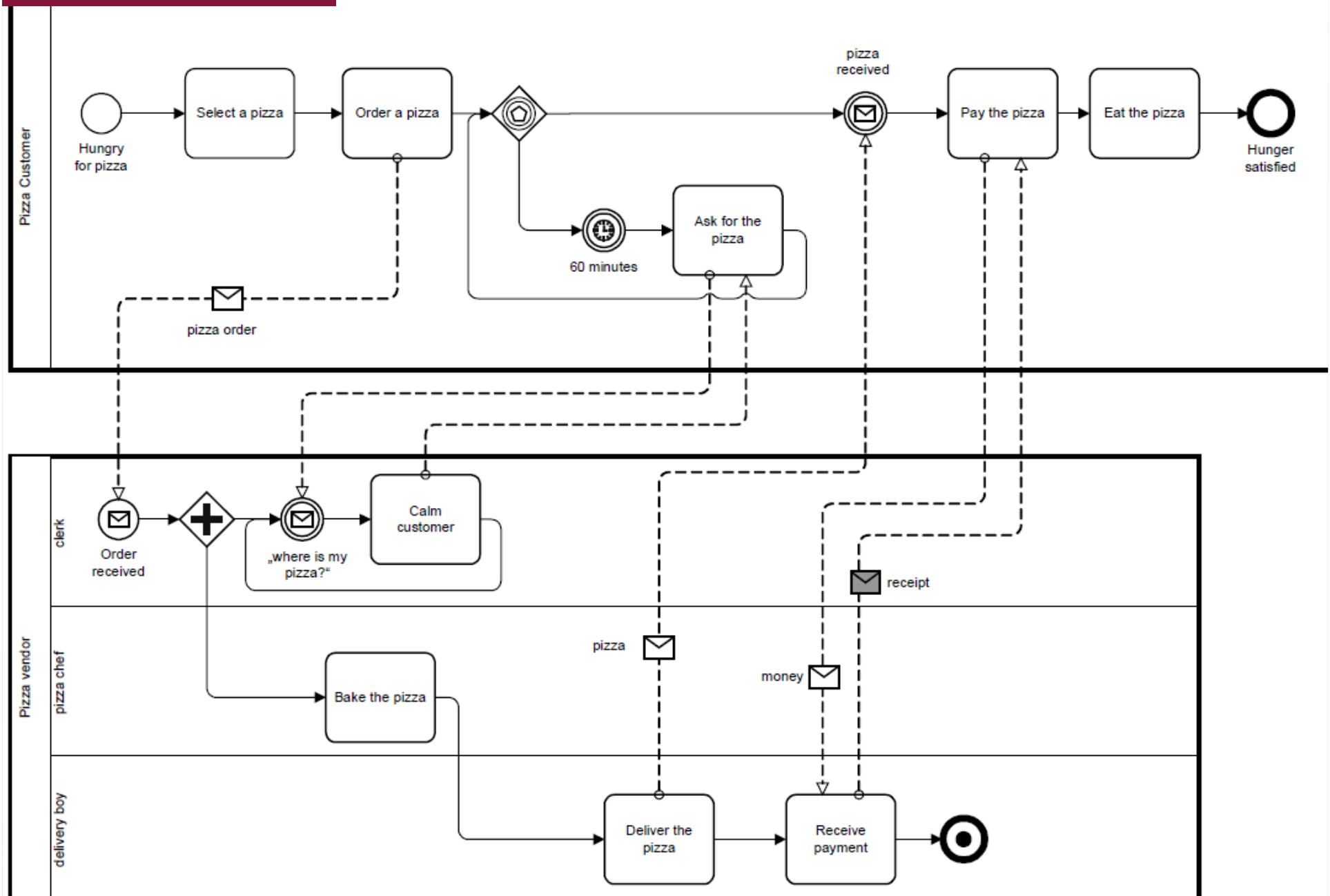
- Are often used for documenting IS and SHOULD Processes in software engineering
- Can be successfully used for specification of detailed flows. (Software Specification and Design)
- Notation is more powerful then EPCs
- BPMN is more suitable for modeling business processes
- BPMN is more suitable for execution by a process engine



- BPMN – Business Process Model and Notation
- Unified notation for many tools and people
- Is used for business as well as for technical modeling, since it is supported by many process engines
- A standard defined by OMG together with many BPM companies



## BPMN 2.0 Example

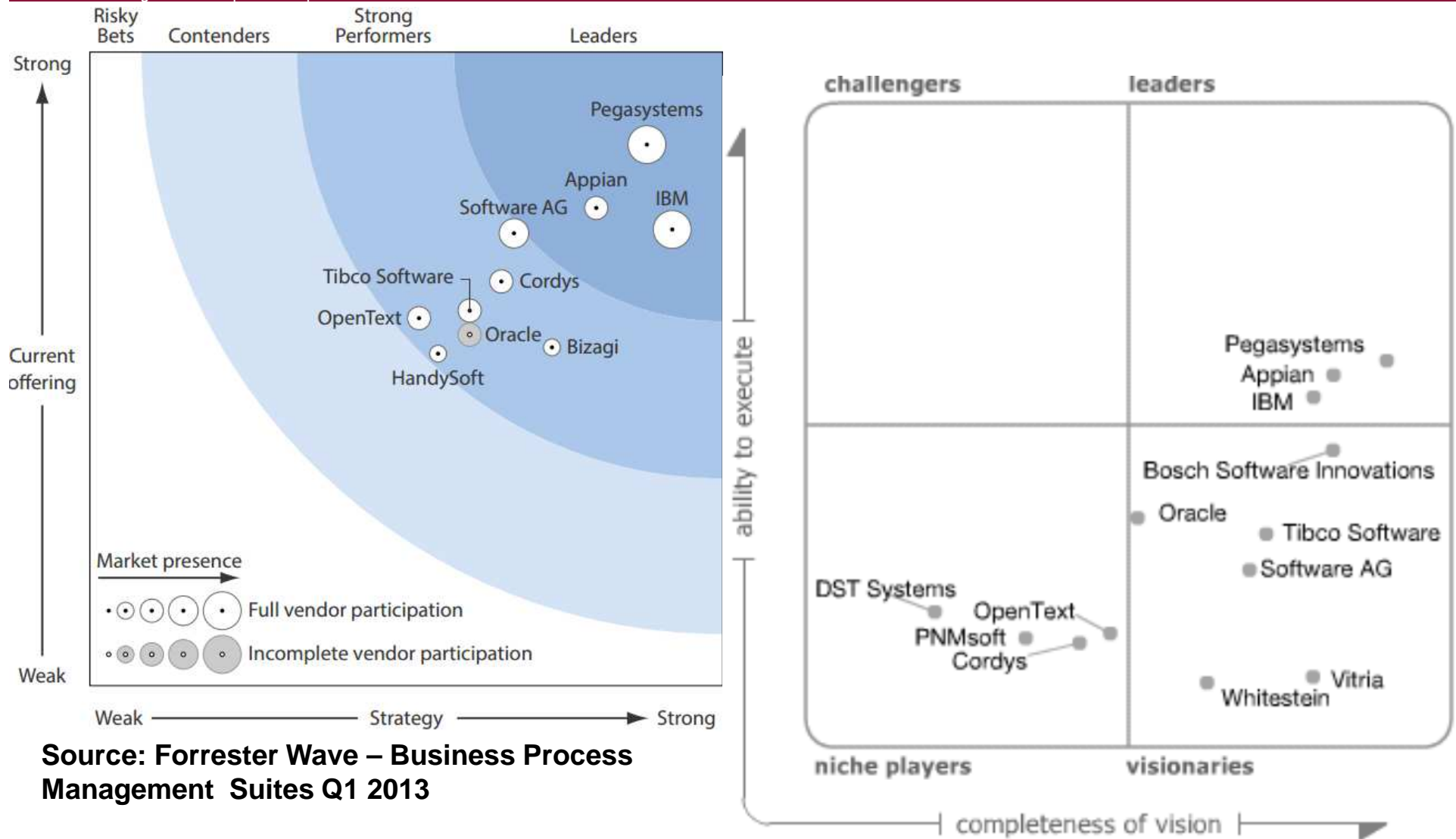


# AGENDA

1. BPM Background
2. Business Process Modeling
- 3. Industrial BPM Systems**
4. BPM Best Practices
5. Trends

# Forrester and Gartner: BPM Market Consolidation

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Source: Forrester Wave – Business Process Management Suites Q1 2013

As of September 2012



Pegasystems is the industry leader in **Business Process Management (BPM)** software solutions.

## Company Highlights

- Revenues for 2012 of \$461 million
- Publicly held (NASDAQ: PEGA)
- Employees > 2300
- Since 1983
- Based in Cambridge, Massachusetts, with regional offices across North America, Europe, India and Asia Pacific

## Build for Change® Technology

Pegasystems' patented Build for Change technology puts change in the hands of business users. Solutions directly capture *business objectives* and *eliminate manual programming*, so organizations can quickly adapt to meet the demands of changing business requirements.

## Pegasystems SmartBPM® Suite

The heart of SmartBPM is the industry-leading business rules management system that drives and binds all aspects of the system. Process flows, integration, presentation and customer experience, case management, security, and governance are all unified within a common platform, and solutions are built using a common set of models and views.

# Example: Purchase Order Request

## Case

Order Management System build completely on SmartBPM/PegaRules Process Commander

## Steps

1. Login as WorkUser to the Order Management System.

The screenshot displays the Pega Work User interface. On the left, the 'Work User' profile is visible, showing details such as Portal Layout (Work User portal), Name (Work User), Application (OrderEntrySystem 01.01.01), Access Group (AlphaCorpApp/WorkUsers), Organization (AlphaCorp.com), Division (Administration), Unit (Technical), and Work group (default@AlphaCorp.com). The main area is titled 'Process Work' and contains a section for 'My Work in Progress'. This section includes a 'Select Work Type' dropdown set to 'All' and a table with columns 'Urgency', 'ID', 'Subject', 'Status', and 'Instructions'. The table currently displays the message 'No matching data was found.' and an 'Expand ...' link.



# Purchase Order Request

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## Case

Order Management System build completely on SmartBPM/PegaRules Process Commander

## Steps

1. Login as WorkUser to the Order Management System.
2. Create New Purchase Order.

Process Work

Process Work

Purchase Order Status New Urgency 10 ID PO-1

Subject: Purchase Order Urgency:

Created: Mar 16, 2009 1:38:00 PM Created by: Work User

Enter Order Items OR --select a different action--

Item	Quantity	Price	Item Total
		\$0.00	\$0.00

Submit

Department Name IT

Department Number 1050

Bill Customer ✓

Order Date 3/16/2009 12:00 AM

Note

Parties Work User

Entry Operator- Work User

# Purchase Order Request

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Case

Order Management System build completely on SmartBPM/PegaRules Process Commander

## Steps

1. Login as WorkUser to the Order Management System.
2. Create New Purchase Order.
3. Add Items to the Order, <Submit>.

Process Work

Purchase Order Status **New** Urgency 10 ID PO-1

Subject: Purchase Order Urgency:

Created: Mar 16, 2009 1:38:00 PM Created by: Work User

Enter Order Items OR --select a different action--

Item	*Quantity	Price	Item Total
Laptop	2	\$2,500.00	\$5,000.00
Keyboard	3	\$39.99	\$119.97
Monitor	2	\$550.00	\$1,100.00
Printer	1	\$325.50	\$325.50

Submit

# Purchase Order Request

## Case

Order Management System build completely on SmartBPM/PegaRules Process Commander

## Steps

1. Login as WorkUser to the Order Management System.
2. Create New Purchase Order.
3. Add Items to the Order, <Submit>.
4. Add shipping details, <Confirm>.

Process Work

Process Work navigation icons: back, forward, refresh, print

---

**Purchase Order**   Status **Open**   Urgency 10   ID PO-1   [edit] [undo] [redo] [delete]

Subject: Purchase Order      Urgency:

Created: Mar 16, 2009 1:38:00 PM      Created by: Work User

---

⇒ **Confirm this order**

Order Total \$6,545.47

Add Shipping Details ☒

**Shipping Information**

Address Line 1

Address Line 2

City

State

Zip

Multiple Deliveries  ▼

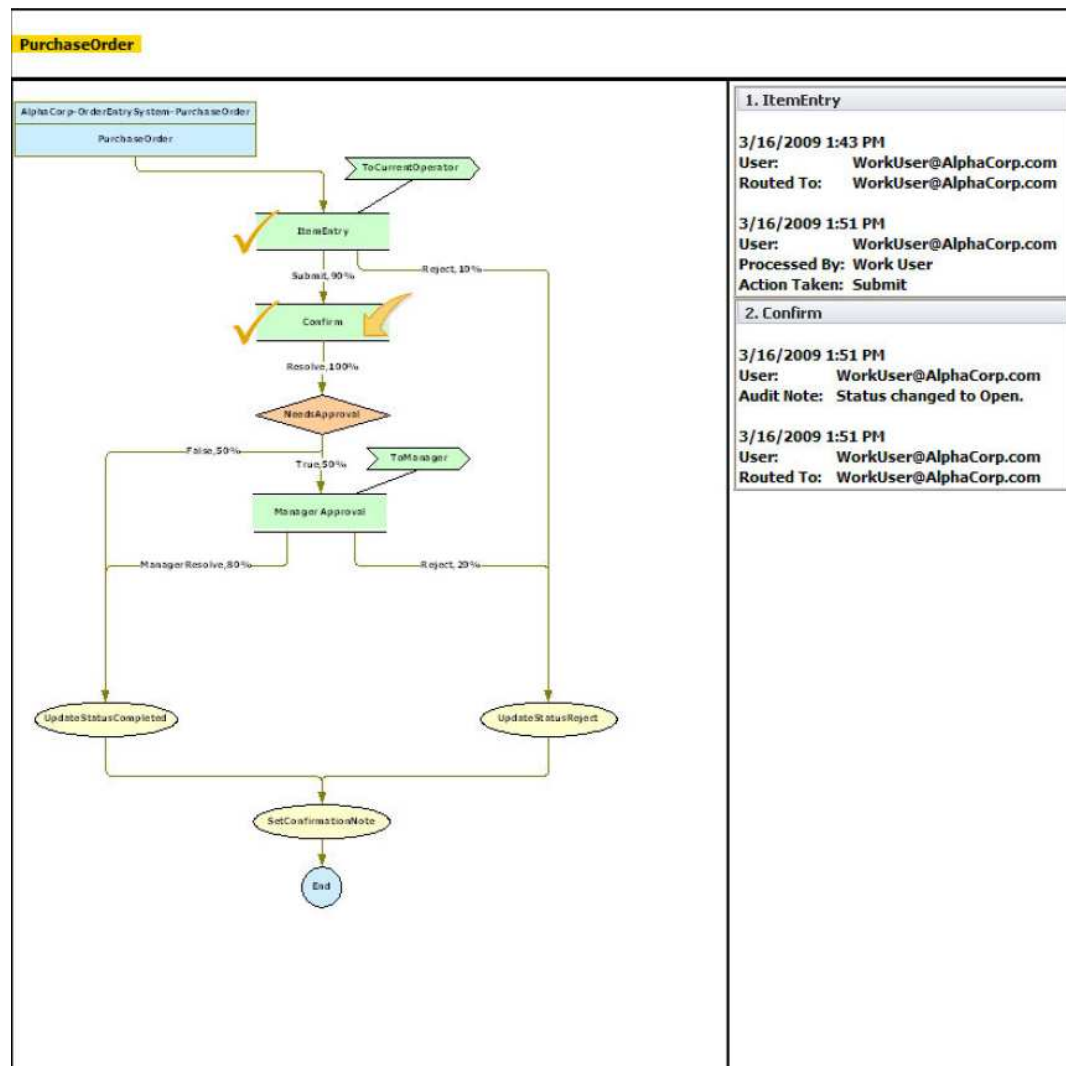
# Purchase Order Request

## Case

Order Management System build completely on SmartBPM/PegaRules Process Commander

## Steps

1. Login as WorkUser to the Order Management System.
2. Create New Purchase Order.
3. Add Items to the Order, <Submit>.
4. Add shipping details, <Confirm>.
5. Where am I in the Process? (check the state)



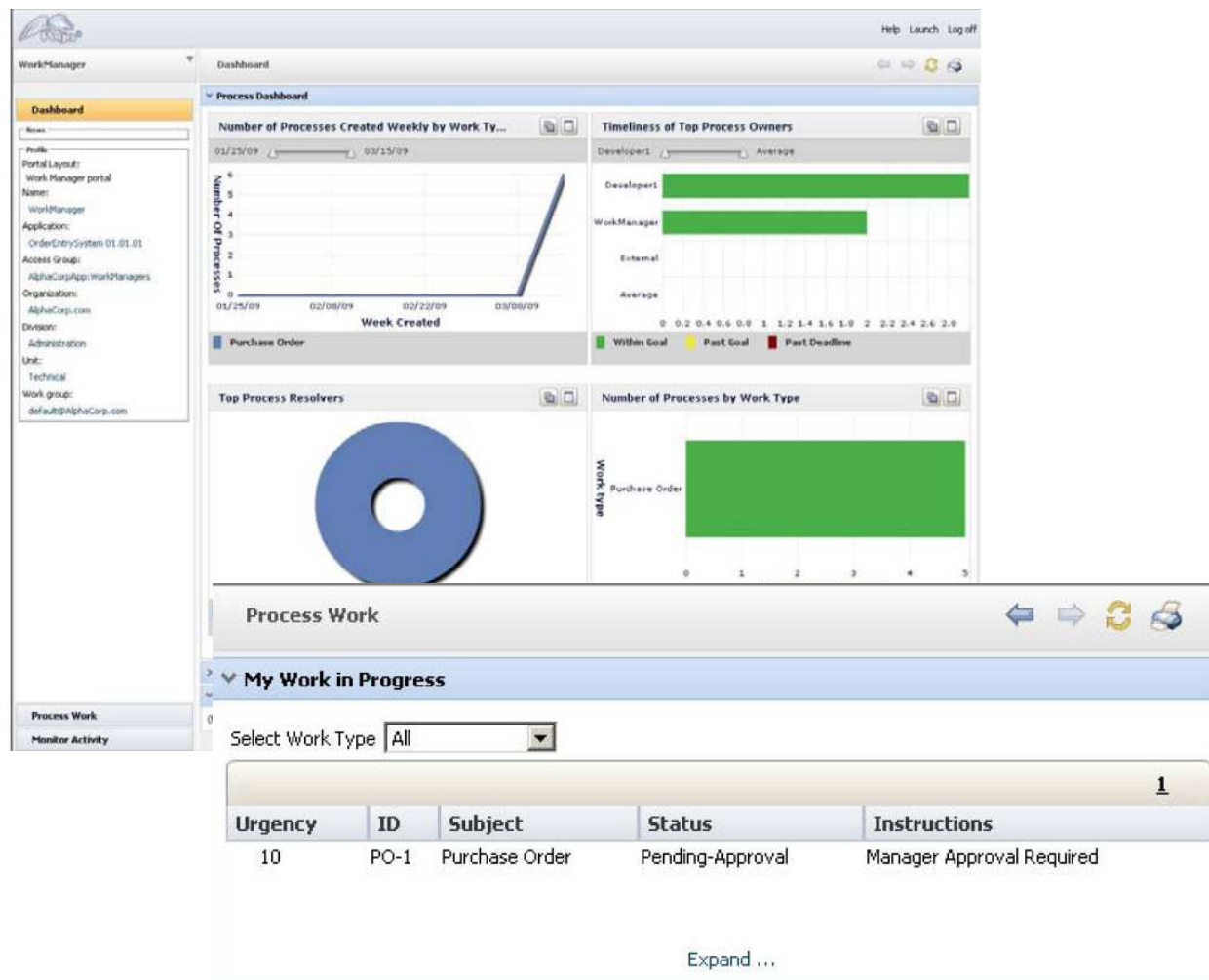
# Purchase Order Request

## Case

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1. Login as WorkUser to the Order Management System.
2. Create New Purchase Order.
3. Add Items to the Order, <Submit>.
4. Add shipping details, <Confirm>.
5. Where am I in the Process? (check the state)
6. Login as WorkManager to the manager portal.



# Purchase Order Request

## Case

Order Management System build completely on SmartBPM/PegaRules Process Commander

## Steps

1. Login as WorkUser to the Order Management System.
2. Create New Purchase Order.
3. Add Items to the Order, <Submit>.
4. Add shipping details, <Confirm>.
5. Where am I in the Process? (check the state)
6. Login as WorkManager to the manager portal.
7. Approve Purchase Order.



Process Work

Navigation icons: back, forward, refresh, print

---

**Purchase Order** Status: Pending-Approval Urgency: 10 ID: PO-1

Subject: Purchase Order Urgency:

Created: Mar 16, 2009 1:38:00 PM Created by: Work User

---

**Take Action**

Order Total \$6,545.47

Approve Reject

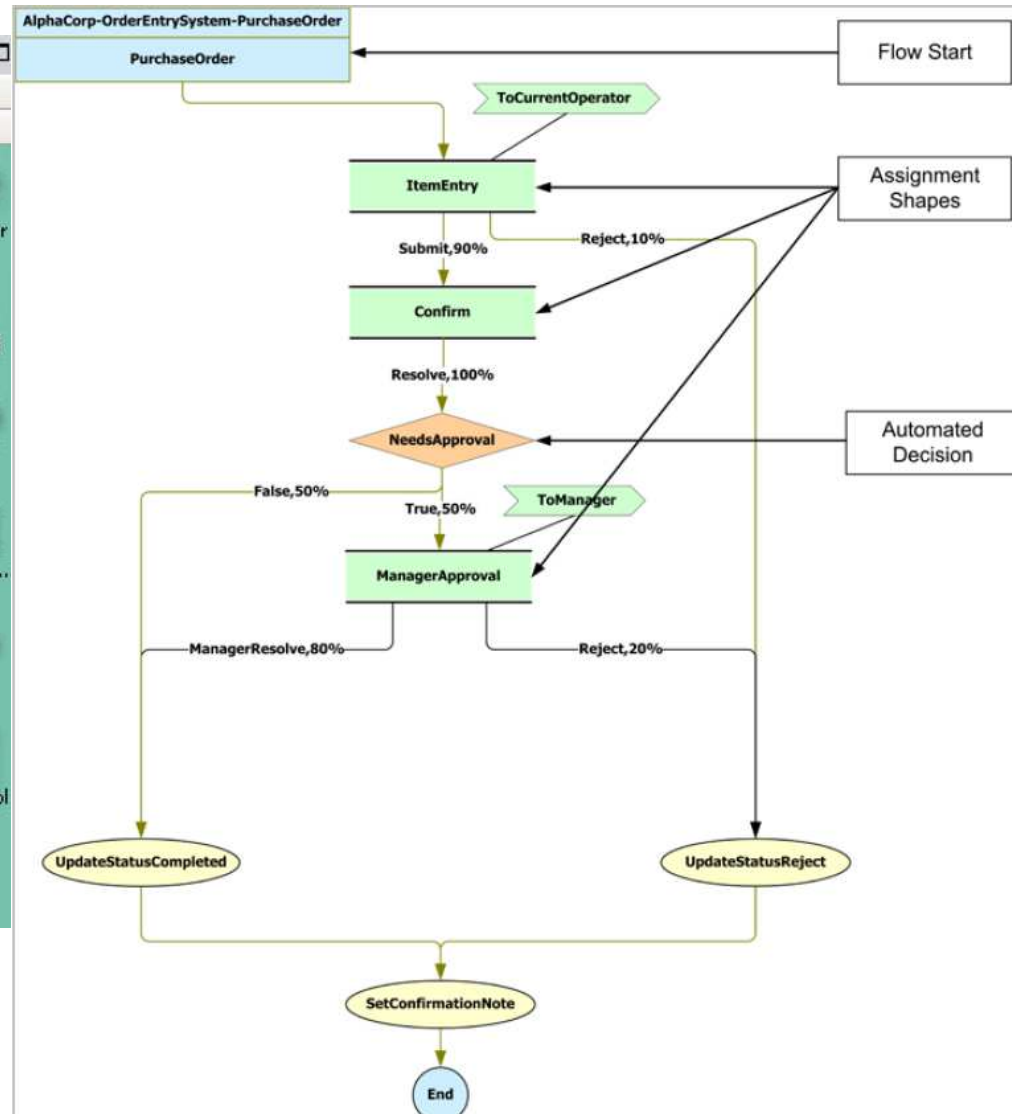
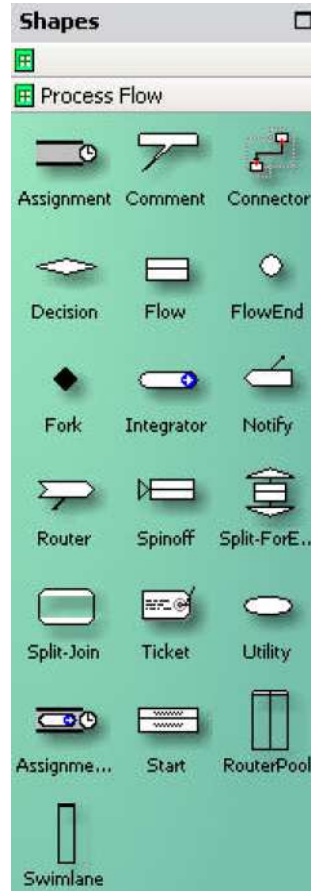
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Order Details	Dept Information	Parties																				
<table><thead><tr><th>Item</th><th>Quantity</th><th>Price</th><th>Item Total</th></tr></thead><tbody><tr><td>Laptop</td><td>2</td><td>\$2,500.00</td><td>\$5,000.00</td></tr><tr><td>Keyboard</td><td>3</td><td>\$39.99</td><td>\$119.97</td></tr><tr><td>Monitor</td><td>2</td><td>\$550.00</td><td>\$1,100.00</td></tr><tr><td>Printer</td><td>1</td><td>\$325.50</td><td>\$325.50</td></tr></tbody></table>	Item	Quantity	Price	Item Total	Laptop	2	\$2,500.00	\$5,000.00	Keyboard	3	\$39.99	\$119.97	Monitor	2	\$550.00	\$1,100.00	Printer	1	\$325.50	\$325.50		
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## Modeling the Process Flow – Flow Rule

### Contents

- Assignment Shapes – Tasks, when user enters info
- Automated Decisions – Calculating the rules
- Routers for User Assignment





The screenshot displays the PegaRules Process Commander (PRPC) development environment. On the left, the 'App Explorer' shows a tree structure for the 'AlphaCorp-OrderEntrySystem' application. The 'PurchaseOrder' object is expanded, showing properties like 'Address', 'ApprovalCode', and 'PaymentDate'. A red arrow points from the 'ApprovalCode' property to the 'Approval Code' field in the form design.

The main workspace shows the 'FLOW ACTION AlphaCorp-OrderEntrySystem-Purchase' configuration. The 'Applies To' is 'AlphaCorp-OrderEntrySystem' and the 'Action Name' is 'VPResolve'. The 'Short Description' is 'Approve'. Below this, the 'Form' tab is active, showing a design canvas with a 'LABEL' and a 'FIELD' (containing 'Approval Code'). A red arrow points from the 'Approval Code' field to the 'Label' widget in the 'Form' tab.

The 'Form' tab also shows a 'History' tab with a list of widgets: 'Label', 'Input Box', 'Text Area', 'Icon', 'Button', 'Check Box', 'Radio Button', 'URL', 'Calendar', 'Select', and 'Image'. The 'Label' widget is highlighted in the list.

- Pegasystems continues to lead with a strategic focus on delivering horizontal and vertical frameworks, built on top of its Pega BPM platform. Although the core BPM environment still requires a **significant upfront investment** in training and certification, arguably the platform lives up to its promise of **delivering business agility**. Key to this shift is Pegasystems' "**next-best-action**" capability, which uses a sophisticated correlation engine to predict and recommend the next recommended step a user should take for a given process.
- While Pegasystems has a long track record as a leader in the BPM suite market, the vendor's offering has always been tagged as **developer centric**, offering little functionality targeting nontechnical users and business architects. In the winter of 2012, Pegasystems unveiled a new component, "**business profiler**," which targets business architects and is designed to help teams define, track, and manage the strategic aspects of delivering BPM.

Source: Forrester Wave Business Process Management Suites, Q1 2013

# Other Systems and Companies

# Appian

Profil

Appian is a Global Innovator in Mobile, Cloud and Social BPM



webMethods

IBM  
Business  
Process  
Manager

TIBCO

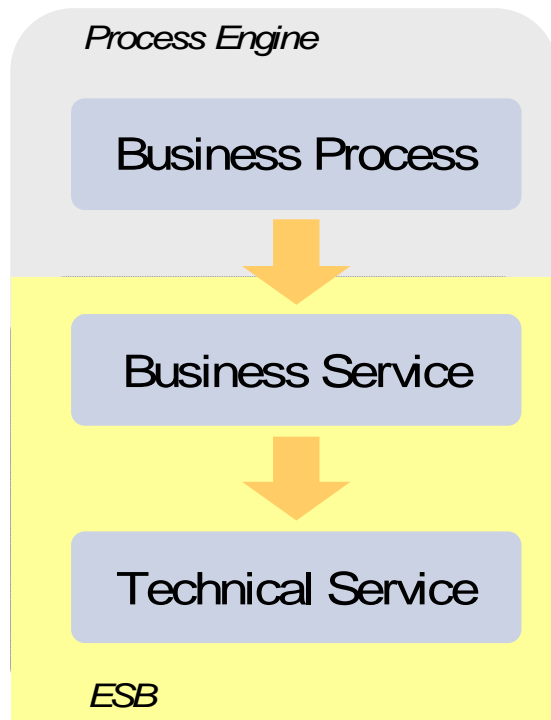
ORACLE  
BPM

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1. BPM Grundlagen
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# Modeling: Separation of concerns

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- **Business Processes** represent the real business cases and have a domain-specific canonical *business data model*. The *orchestration* of services is done on this level. Business Services or *Subprocesses* are used within the processes.
- **Business Services** represent the *reusable and self-contained* services, which utilize the technical services. They are responsible for *transforming* the technical data models of technical services into the canonical business data model. Business Services can call other *Business Services*.
- **Technical Services** are responsible for encapsulating the *technical binding* of applications and data. They know the data structures and functions of *specific applications*. They use specific interfaces to Files, Databases, Queues, etc. directly or with the help of adapters. They reference physical resources. They provide *different interfaces* (e.g. Webservices, REST, Java RMI, etc...).

## Modeling: Structure the process

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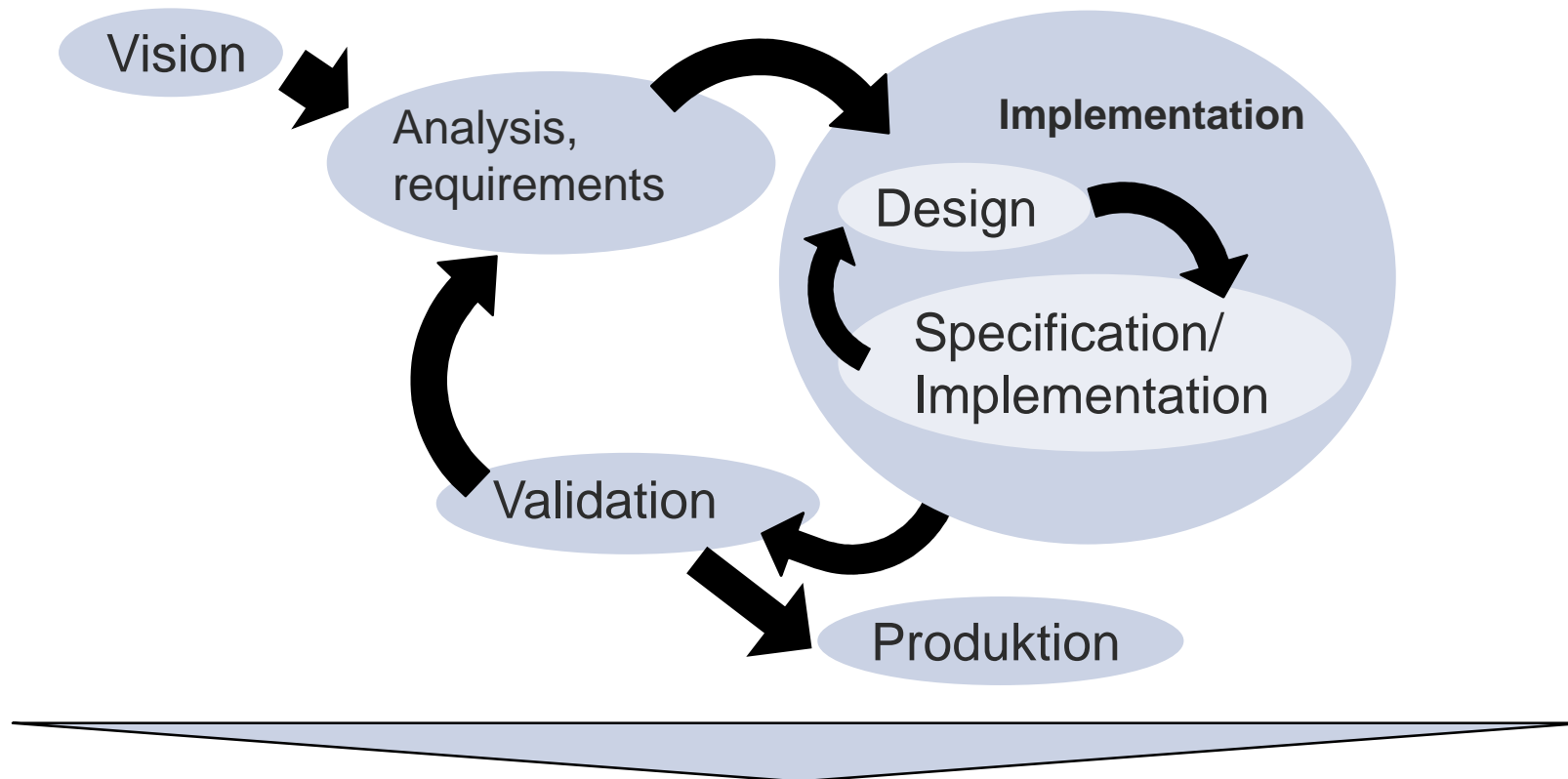
Workflow is a service which orchestrates the other services,  
which can be workflows again

- The *structuring* of workflows is *essential*, otherwise even the simplest processes can become complicated.
- Every *subprocess* should be built as a separate workflow, which is orchestrated into the main process
- Even the *activities* of subprocesses can be modelled as separate workflows if they are reusable and independent.
- Workflow structuring enables better *reuse* and *separation of concerns*.  
E.g. escalations or exception handling can be built as separate parameterized workflows

## Develop processes incrementally and iteratively

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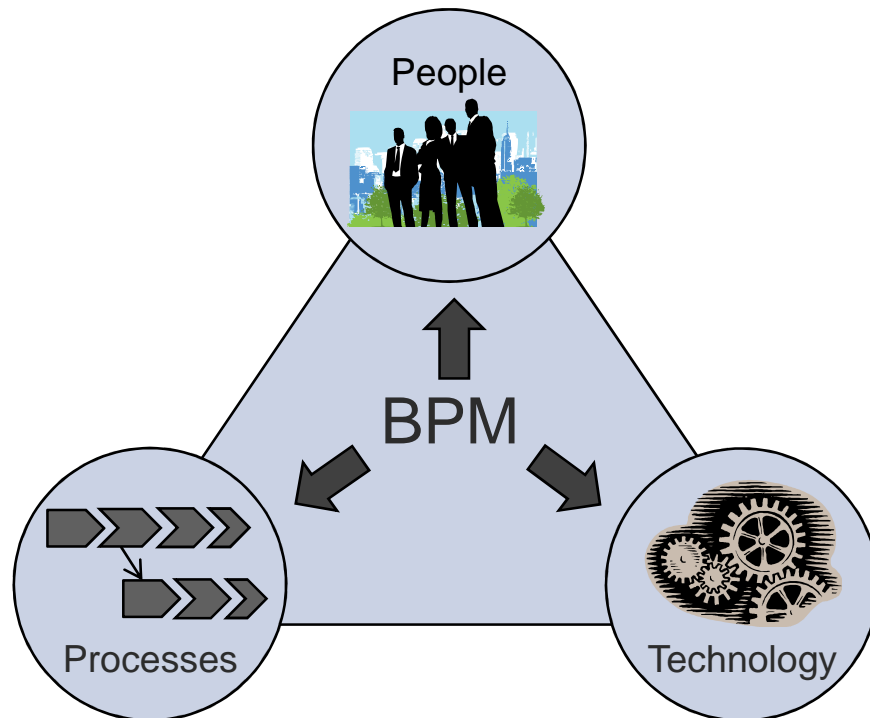
- The cost of business process analysis is increasing disproportionately, when people consider all the exceptions, rules and particular cases. Even business experts usually do not know all the *peculiarities*.
- A process defined for *80 – 90% of cases* can already be used for the first development iteration.
- Rapid development of the first version leads to the *quick business feedback* and initiates a detailed discussion of exceptions and rules. During the further iterations the process is stepwise refined and exceptions are handled.
- The core of the business process automation is „incremental“, since the implementation is growing incrementally over multiple iterations.



BPM influences the software development process

- The biggest work on the specification (e.g. use cases, workflows) is done during the implementation phase
- The result of every iteration is a working application, not a paperwork (Detailed documentation is generated)





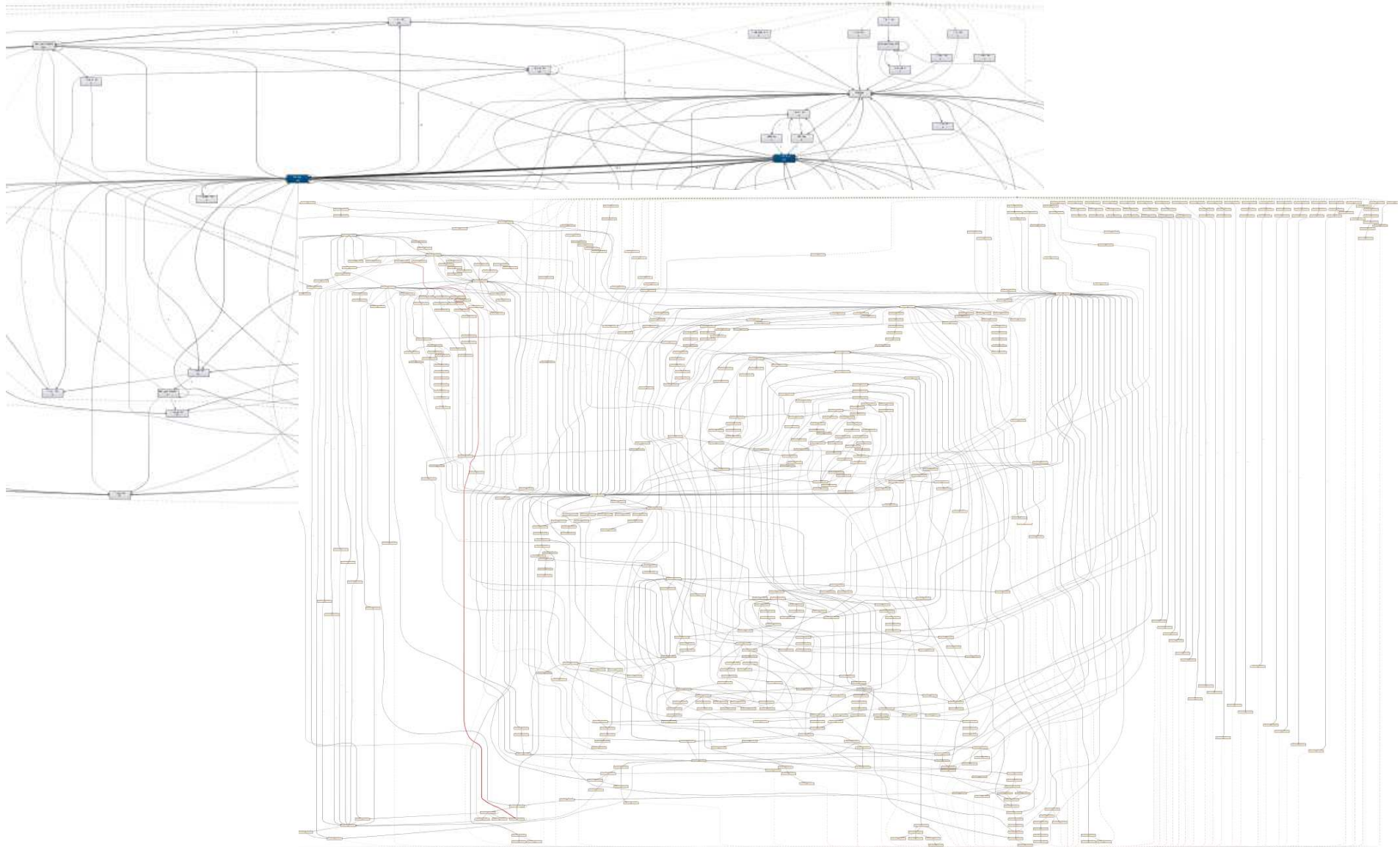
- „Bring the decision to the place where it will be carried out“, since on this place people know what to do and what to improve
- BPM projects are change projects! Think about the employees and involve them respectively
- There must be a will to change in the organisation

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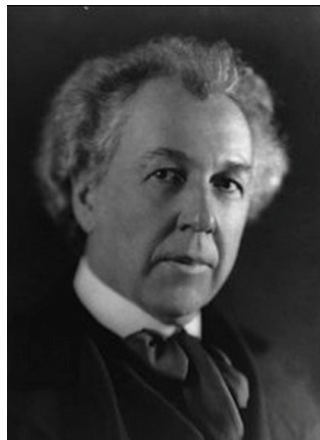
## 5. Trends

# Big Data and Big Processes in Real Life



# From BPM to Process Mining (I)

- Workflow Management and BPM are known since 70th.
- It is not a miracle, hype is gone.
- There is a set of mature market products (Appian, Pega, IBM, etc).
- It is often adopted by many products (ERP, CRM, EAI/SOA,...)



I hate intellectuals. They are from the top down. I am from the bottom up.

(Frank Lloyd Wright)

**LET'S DESCRIBE AND NOT PRESCRIBE**

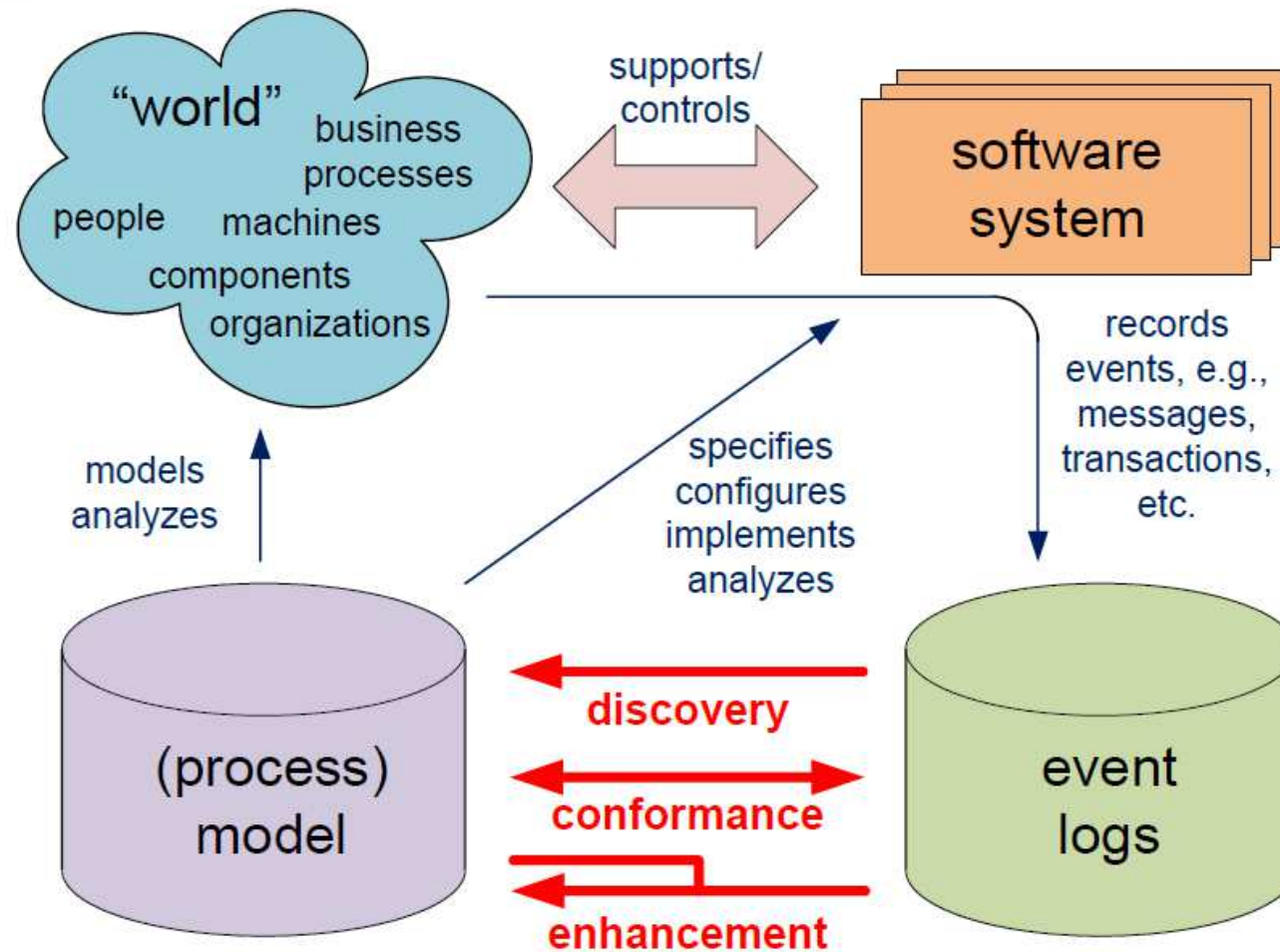


# Desire Paths: Reality versus Models



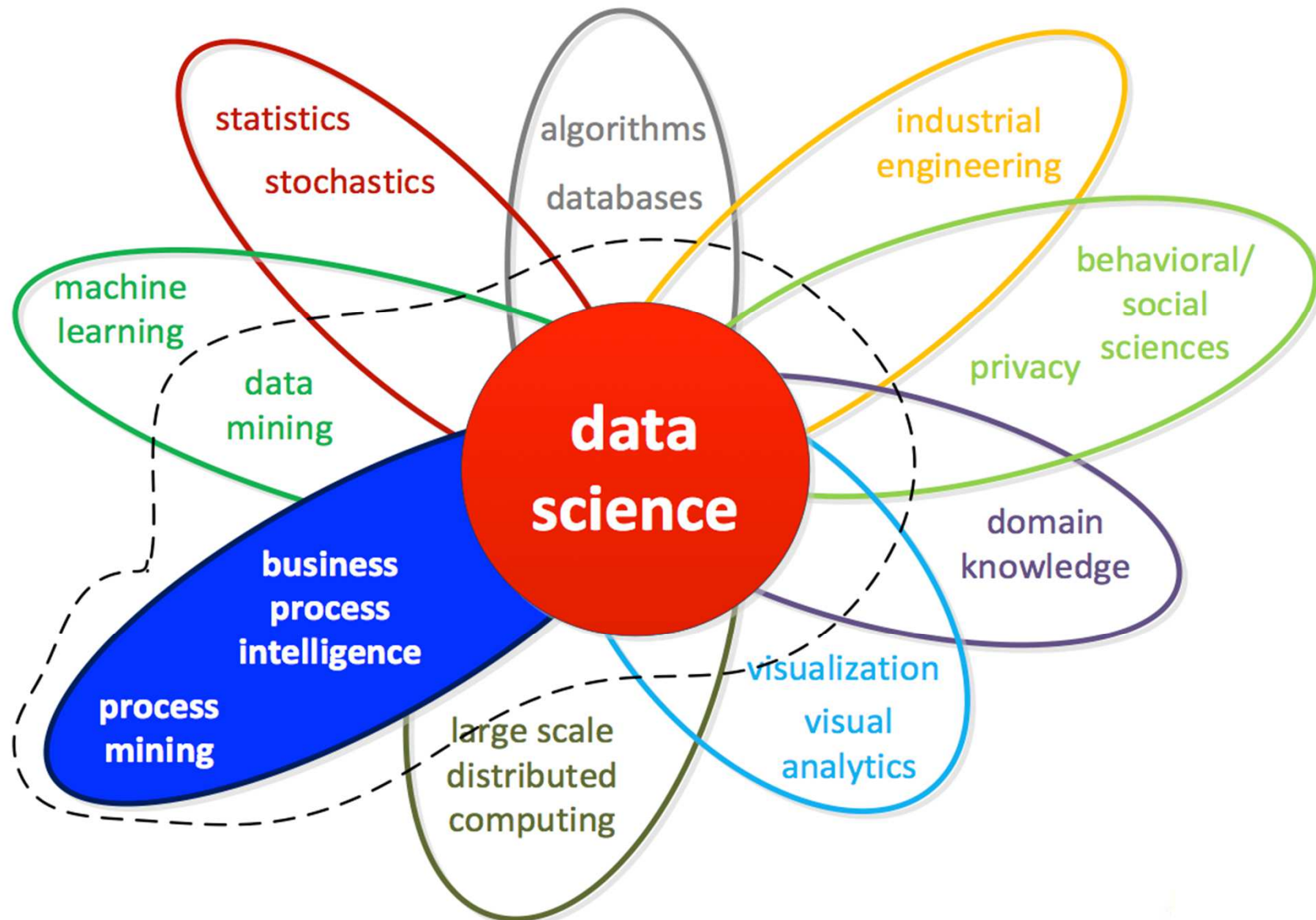
## From BPM to Process Mining (II)

Use the Reality!  
Discover Processes from Event Data.





# From Process Mining to Data Science



## Tasks

- Ask relevant questions.
  - We don't know...
  - We would like to know...
- Hypothesis. Define and run experiments.
- Scoop, scrap, sink business relevant data
- Model data. Model Algorithms.
- Understand data relationships.
- Explore and Discover data.
- Learn and mine the data (automation)
- Create Data Products, Integrate Products
- Produce Business Stories and Solutions
- Communicate!

## Toolset

- Java, R, Python (+ Clojure, Scala)
- Hadoop, HDFS, MapReduce (+ Storm, Spark)
- Hbase, Pig & Hive (+ Impala, Cascalog)
- ETL, Flume, Sqoop
- SQL, RDBMS, DW, OLAP
- RapidMiner, Weka (+ Knime, SciPy, NumPy)
- Process Mining: ProM, Disco
- Gephi, Tableau, Flare, ...
- SPSS, Matlab, SAS
- NoSQL, Mongo DB, Couch
- MS Excel ☺



# Data Science: the Future



Data science is different



**Vielen Dank für Ihre Aufmerksamkeit**

**Dr. Vladimir Rubin**

GB Travel & Logistics  
Mergenthalerallee 73-75  
65760 Eschborn  
Telefon: +49 6196 7750 5477  
vladimir@rubin-it.com

[www.msg-systems.com](http://www.msg-systems.com)



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