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Business Information Systems Unit 4 Business Processes and Business Process Management

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What is a Business Process?



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- Any combination of activities that contribute to an individual, identifiable, desired output that adds value to the business operations.
 - Printing pay checks
 - Processing e-mail orders
 - Exchanging defective parts
 - Credit approval



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Characteristics of Business Processes



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- They have a **duration**, i.e. their execution can span a significant amount of time (not simple request-response)
- They can involve **machine and human actors**.
- They often require **data from other processes** inside the enterprise.
- They may require interaction with and contributions from the customer.



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Key Processes in a Production Firm



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- Offer Process (customer-to-order)
- Order Process (order-to-invoice)
- Product Development (idea-to-market)
- Customer Service (failure-to-invoice)

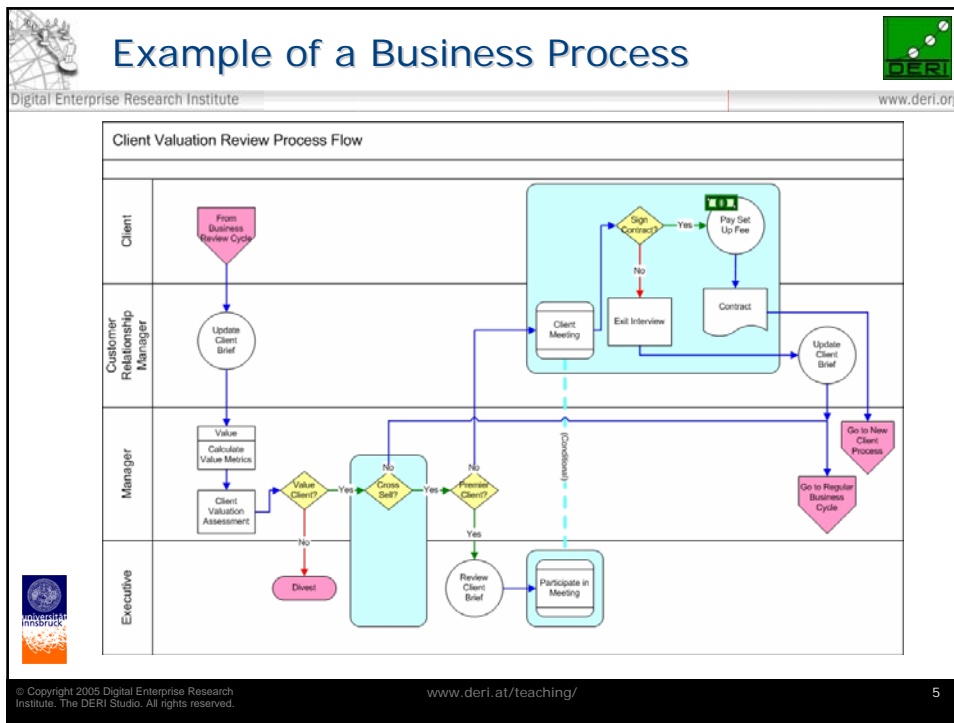
cf. Wigand et al. (2003), p. 80



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Process Models, Process Instances, Ad-hoc Processes

- Some processes are executed in a standardized manner, often based on a formal definition of the process. The latter is called a **Process Model**.
- Process models can be informal or formal and thus machine-readable.
 - **Informal:** McDonald's instructions for assembling a burger
 - **Formal:** UML activity diagram of a process
- An actual execution of a process is called a **Process Instance**.
- Some process instances do not follow a predefined pattern; these are called **Ad-hoc Processes**.

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The Process Space of an Enterprise

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- Complex
- Dependencies
- Concurrent
- Access to scarce resources
- Evolutionary character

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Process Integration

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Horizontal Integration cf. Wigand et al. (2003), p. 80

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Companies are subject to competition in at least three dimensions

Cost per Process Execution

Delay of Process Setup

Lack of Efficiency

Cost of Process Setup

Lack of Evolutionary Granularity

Lack of Agility

cf. Hepp et al. (2005)

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The Critical IT / Process Divide

Business Experts' Perspective: Processes

Querying the Process Space

Manual Labor

Process Implementation

IT Implementation Perspective

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P2A: Workflow Management Systems



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- First era of process automation
- WfMS – a system that „supports a specific set of business processes through the execution of a **process specification**“
- Perspectives:
 - Resources and Resource Management
 - Organizational Units
 - Tasks and Task Management
 - Data and Data Flow
 - Temporal Aspects (e.g. deadlines and durations)
 - Applications
 - Business Rules
 - Exception Handling



cf. A. Oberweis: Person-to-Application Processes: Workflow Management, in Dumas/van der Aalst/ ter Hofstede: Process-Aware Information Systems

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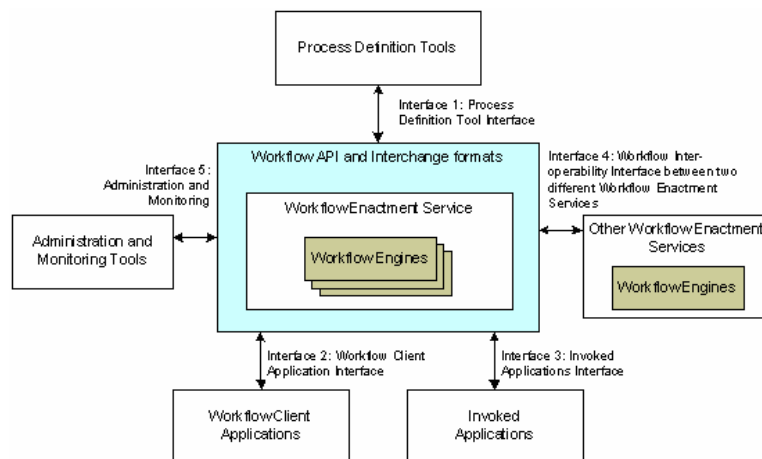


WfMC Reference Model



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Source: <http://www.bptrends.com/images/glossary/WorkflowReferenceModel.gif>


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Challenges of Workflow Mgm Systems




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- Lag in modeling or modifying workflow types (= models)
- Alternative approach: Workflow Mining
- Multiple workflow definition languages



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P2P: Computer-Supported Collaborative Work



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- Focus: Collaboration between human actors
- Difference to WfMS: P2P instead of P2A
 - interaction instead of sequential contributions
- Core challenges: Complexity of social interaction
 - supporting without restricting
 - e.g. voting mechanisms
- A form of a CSCW: Wiki infrastructure



cf. Ellis/Barthelmess/Chen/Wainer: Person-to-Person Processes: Computer-supported Collaborative Work, in Dumas/van der Aalst/ ter Hofstede: Process-Aware Information Systems

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M2M: Enterprise Application Integration and Supply-Chain Integration



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- **EAI**: Integrating processes, data flows, and systems inside an enterprise
- Business environments are usually heterogenous, autonomous, and distributed („HAD“).
- Reasons: Historically grown systems landscape, decentralized decision making
- Lack of a „Chief Integration Officer“
- Due to inherent change, systems evolve in an uncoordinated manner
 - non-synchronized software updates / release changes
 - modifications in data representation and services choreographies
- Web services (SOAP-based) offer at least a technological base for exposing legacy functionality



cf. C. Bussler: Enterprise Application Integration and Business-to-Business Integration Processes, in Dumas/van der Aalst/ ter Hofstede: Process-Aware Information Systems

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M2M: Supply-Chain Integration



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SCOR is Based on Five Distinct Management Processes



Source: <http://www.supply-chain.org>

Integration of processes that have independent paths of evolution!

The same process can be part of multiple supply chains!



cf. C. Bussler: Enterprise Application Integration and Business-to-Business Integration Processes, in Dumas/van der Aalst/ ter Hofstede: Process-Aware Information Systems

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The Sense and Nonsense of Business Process Modeling and Business Process Reengineering



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- Modeling existing processes is costly and takes time
- Many processes are „home-grown“ and do not follow best practices.
- As a consequence, modeling existing, sub-optimal processes for later implementation can be nonsense, because
 - the process itself could be improved
 - the process might change in the meantime
- Trend: Comprehensive packages of business software as libraries of best practices
 - also simplifies supply chain integration, reporting, ...



cf. R. Thome, A. Hufgard: Continuous System Engineering, Würzburg 1996.

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Process Modeling



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- **UML**
 - General idea of UML: common framework for software engineering notations that cover varying aspects
 - General challenge of UML: Ground all models in a common formal semantics
 - Most important model for Process Modeling: **Activity Diagrams**
 - Also: Class Diagrams for organizational structure etc.
- **Event-Driven Process Chains (EPCs)**
 - key component of SAP ERP software for business engineering
- **Petri Nets**
 - Models of distributed and concurrent discrete dynamic systems with a focus on local consequences of operations
 - Various subtypes of Petri Nets
 - strong formal grounding

[1] Engels/Förster/Heckel/Thöne: Process Modeling Using UML

[2] Scheer/Thomas/AdamA. Oberweis: Process Modeling Using Event-Driven Process Chains,

[3] J. Desel: Process Modeling Using Petri Nets

All in: Dumas/van der Aalst/ ter Hofstede: Process-Aware Information Systems



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Process Mining



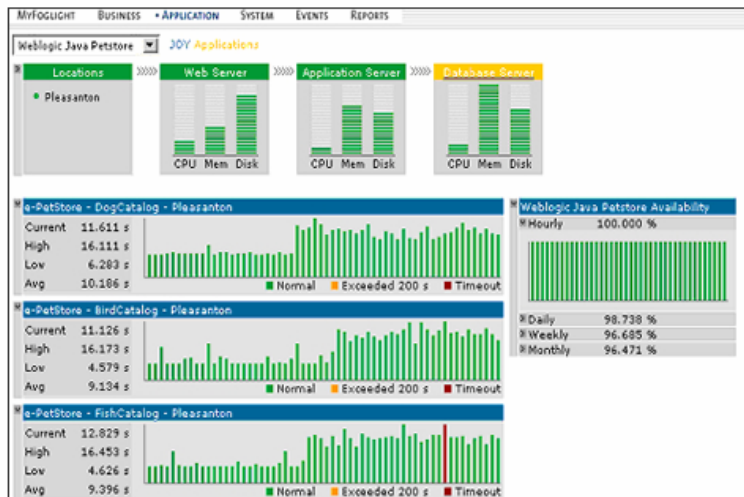
- Idea: WfMS and other Information Systems leave a lot of data about how processes are actually executed and how systems are used
 - Log files
 - execution times
 - Menu paths followed etc.
- This can be used to
 - identify mismatches between software usage and predefined processes
 - identify the need for new processes



cf. van der Aalst/Weijters: Process Mining,
 in Dumas/van der Aalst/ ter Hofstede: Process-Aware Information Systems



Business Process Monitoring: Technical Perspective



Business Process Monitoring: Business Perspective

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The Six Sigma Principle of Process Quality

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- **Idea:** Make defective parts or insufficient service delivery an extremely unlikely event.
- **Background:** The more complex business interactions are, the more costly is the occurrence of any component failure
- **Example:**
 - one defective seat prevents the completion of a whole car and can interrupt the overall production run
 - a defective power supply or CD-ROM in a cell phone package can lead to extremely costly product exchange and service operations
- **Definition:** Less than 3.4 parts per million parts (or service transactions) are allowed to exceed the lower or upper limit of product specification.


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The Six Sigma Principle of Process Quality (2)

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- It is **impossible** to produce
 - sausages that weigh **exactly** 100 grams,
 - foils that are **exactly** 100 mm wide,
 - corn flakes packages that contain **exactly** 250 grams,
 - match boxes that **always** contain 100 matches.
- The likelihood for a continuous variable in a stochastic process to have exactly a discrete value is zero. **Only intervals** for values **may have a non-zero likelihood**.
- **There is always variance**, due to
 - human error,
 - limitations of measuring,
 - unavoidable tolerances in machines and operations.

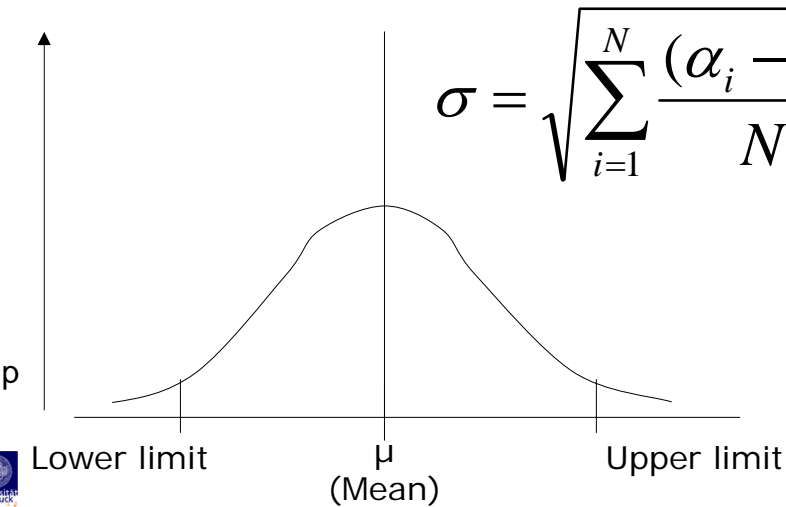

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Process Quality: Distribution and Variance

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$$\sigma = \sqrt{\sum_{i=1}^N \frac{(\alpha_i - \mu)^2}{N^*}}$$



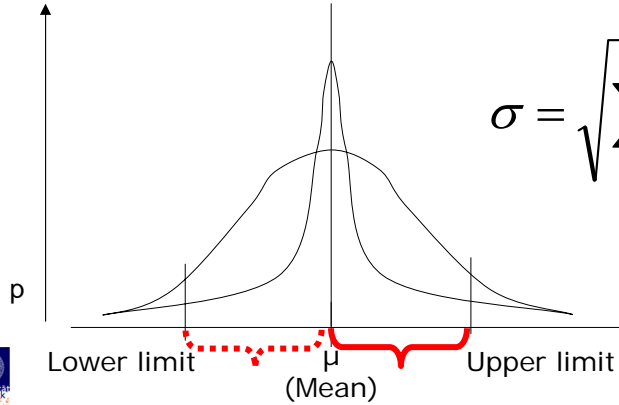
The figure shows a normal distribution curve on a coordinate system. The vertical axis is labeled 'p'. The horizontal axis has three marked points: 'Lower limit', 'μ (Mean)', and 'Upper limit'. A vertical line extends from the mean μ to the peak of the curve.


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The Six Sigma Principle of Process Quality

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Six Sigma Principle:
 The distance between the mean and the upper limit and between the mean and the lower limit **is equal or greater than 6 times the variance.**



$$\sigma = \sqrt{\frac{\sum_{i=1}^N (\alpha_i - \mu)^2}{N^*}}$$

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Example: SLA for a Call Center Process

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- Service Level Agreement
 - every call should be answered in less than 20 seconds
- Log file
- **Is this a Six Sigma Process?**

Incoming	Answered	Delay
11:03:50	11:03:51	00:00:01
11:03:52	11:03:59	00:00:07
11:03:57	11:04:30	00:00:33
11:04:13	11:04:15	00:00:02
11:03:50	11:03:59	00:00:09
11:03:52	11:04:30	00:00:38
11:03:57	11:03:59	00:00:02
11:04:13	11:04:15	00:00:02
11:03:50	11:04:30	00:00:40
11:03:52	11:03:59	00:00:07

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Example: SLA for a Call Center Process

Incoming	Answered	Delay
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11:03:57	11:04:30	00:00:33
11:04:13	11:04:15	00:00:02
11:03:50	11:03:59	00:00:09
11:03:52	11:04:30	00:00:38
11:03:57	11:03:59	00:00:02
11:04:13	11:04:15	00:00:02
11:03:50	11:04:30	00:00:40
11:03:52	11:03:59	00:00:07

Mean:
 $\mu = (1+7+33+2+9+38+2+2+40+7)/10$
 $= 14.1$

$$\sigma^2 = \sum_{i=1}^N \frac{(\alpha_i - \mu)^2}{N^*}$$

$\sigma^2 = 233.69$
 $\sigma = 15.29$

Upper limit: 20 secs
Upper limit – mean: 5.9
 $6 * \sigma = 91.72$

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