Business Information Systems
Unit 5
Business Processes and Software

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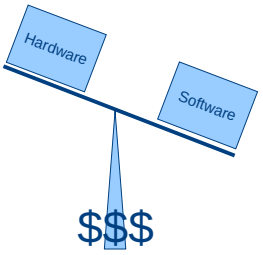
Hardware vs. Software

- **Hardware:** The tangible components of a computer system
  - CPU, power supply, display, memory, ...
- **Software:** The intangible components of a computer system
  - Applications
  - Operating system
  - Data
  - Documentation and instructions

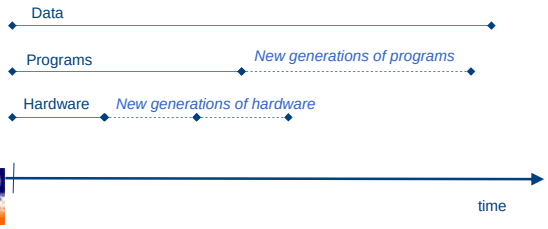


cf. Stair/Reynolds

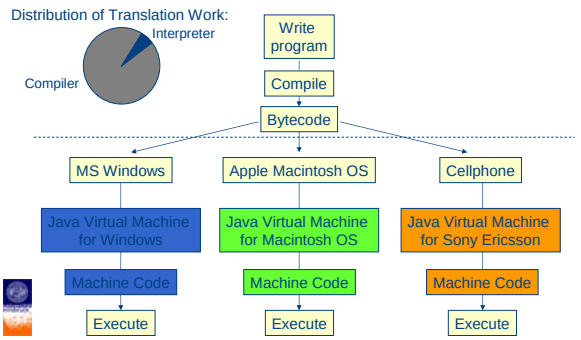
The Economics of Software Development

- High development costs, low distribution costs
- Network Externalities in the Software Market
  - Direct Network Effects
  - Indirect Network Effects

Duration of Use: Hardware, Programs, and Data



Economic Advantages of the Java Approach



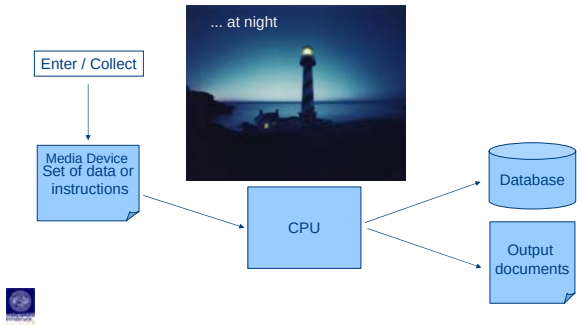
Off-the-Shelf Software

- Two approaches of developing software:
  - Custom development: Software for one particular usage
  - Common-of-the-Shelf (COTS): Software for a large number of usages
    - MS Office
    - SAP
    - Netscape

What is **Integrated** Software?

- Data Integration: "One fact at one place"
- Functionality Integration: one function can interact with others (copy and paste inside one program)
- Application Integration: Two or more software applications can interact.
- Process Integration: Two or more business processes are connected.

Batch Processing



What is a Business Process?

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

Characteristics of Business Processes

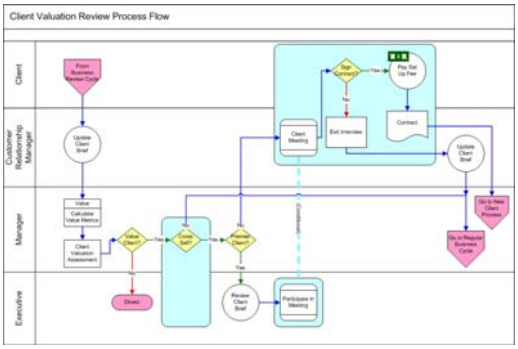
- They have a **duration**, i.e. their execution can span a significant amount of time (not simple request-response)
- They can involve **machine and human actors.**
- They often require **data from other processes** inside the enterprise.
- They may require interaction with and contributions from the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

Key Processes in a Production Firm

- 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

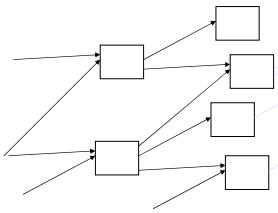
Example of a Business Process



Process Models, Process Instances, Ad-hoc Processes

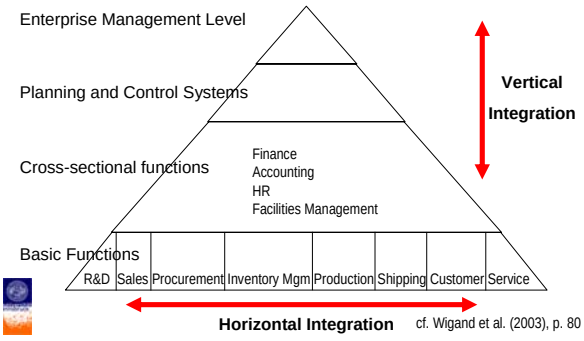
- Some processes are exectuted in a standardized manner, often based on a formal definition of the process. The latter is called a **Process Model.**
- Process models can be informal or formal and thus machine-readable.
  - **Informal:** McDonald's instructions for assembling a burger
  - **Formal:** UML activitiy 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.**

The Process Space of an Enterprise



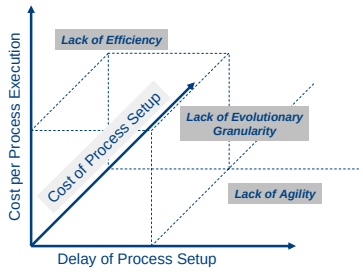
- Complex
- Dependencies
- Concurrent Access to scarce resources
- Evolutionary character

Process Integration



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

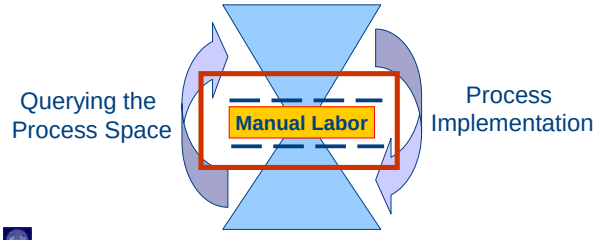
Companies are subject to competition in at least three dimensions



cf. Hepp et al. (2005)

The Critical IT / Process Divide

Business Experts' Perspective: Processes



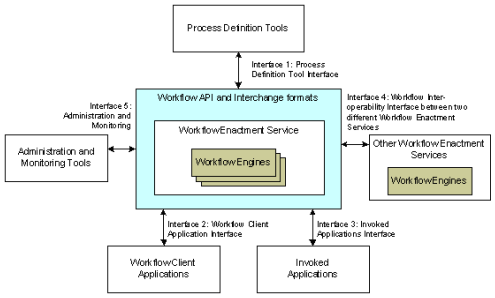
IT Implementation Perspective

P2A: Workflow Management Systems

- 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

WfMC Reference Model



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

Challenges of Workflow Mgm Systems

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

P2P: Computer-Supported Collaborative Work

- 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

M2M: Enterprise Application Integration and Supply-Chain Integration

- **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

M2M: Supply-Chain Integration

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

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

- 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.

Process Modeling

- **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

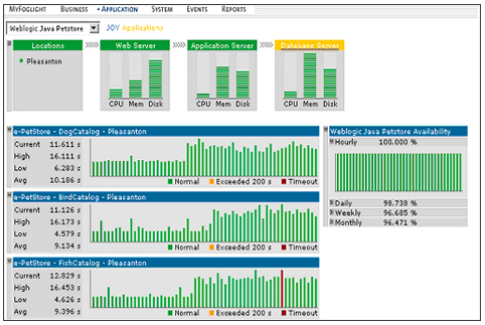
All in: Dumas/van der Aalst/ ter Hofstede: Process-Aware Information Systems

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

The Six Sigma Principle of Process Quality

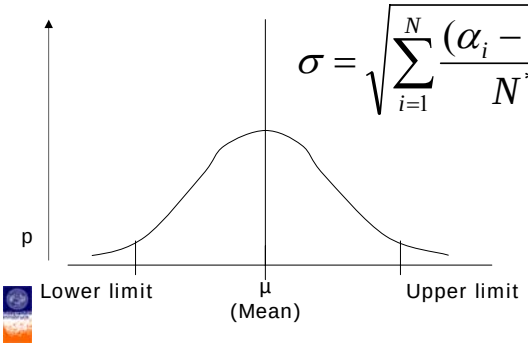
- **Idea:** Make defective parts or insufficient service delivery an extremely unlikely event.
- **Background:** The more complex business interactions are, the more costly is the occurence of any component failure
- **Example:**
  - one defective seat prevents the completion of a whole car and can interrupt 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.

The Six Sigma Principle of Process Quality (2)

- 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 continous 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.

Process Quality: Distribution and Variance

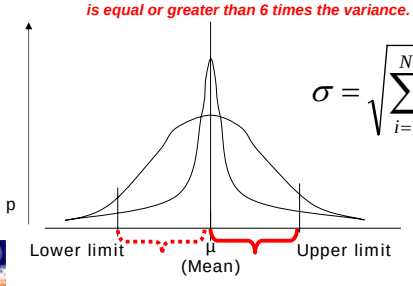
$$\sigma = \sqrt{\sum_{i=1}^{N} \frac{(\alpha_i - \mu)^2}{N^*}}$$



The Six Sigma Principle of Process Quality

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.***

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



Example: SLA for a Call Center Process

- 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

Example: SLA for a Call Center Process

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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:
μ = (1+7+33+2+9+38+2+2+40+7)/10
= 14.1

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

σ^2 = 233.69
σ = 15.29

Upper limit: 20 secs
Upper limit – mean: 5.9
6 * σ = 91.72