

Erfahrungen mit dem Experience-Factory-Ansatz

Klaus-Dieter Althoff & Jens Mänz

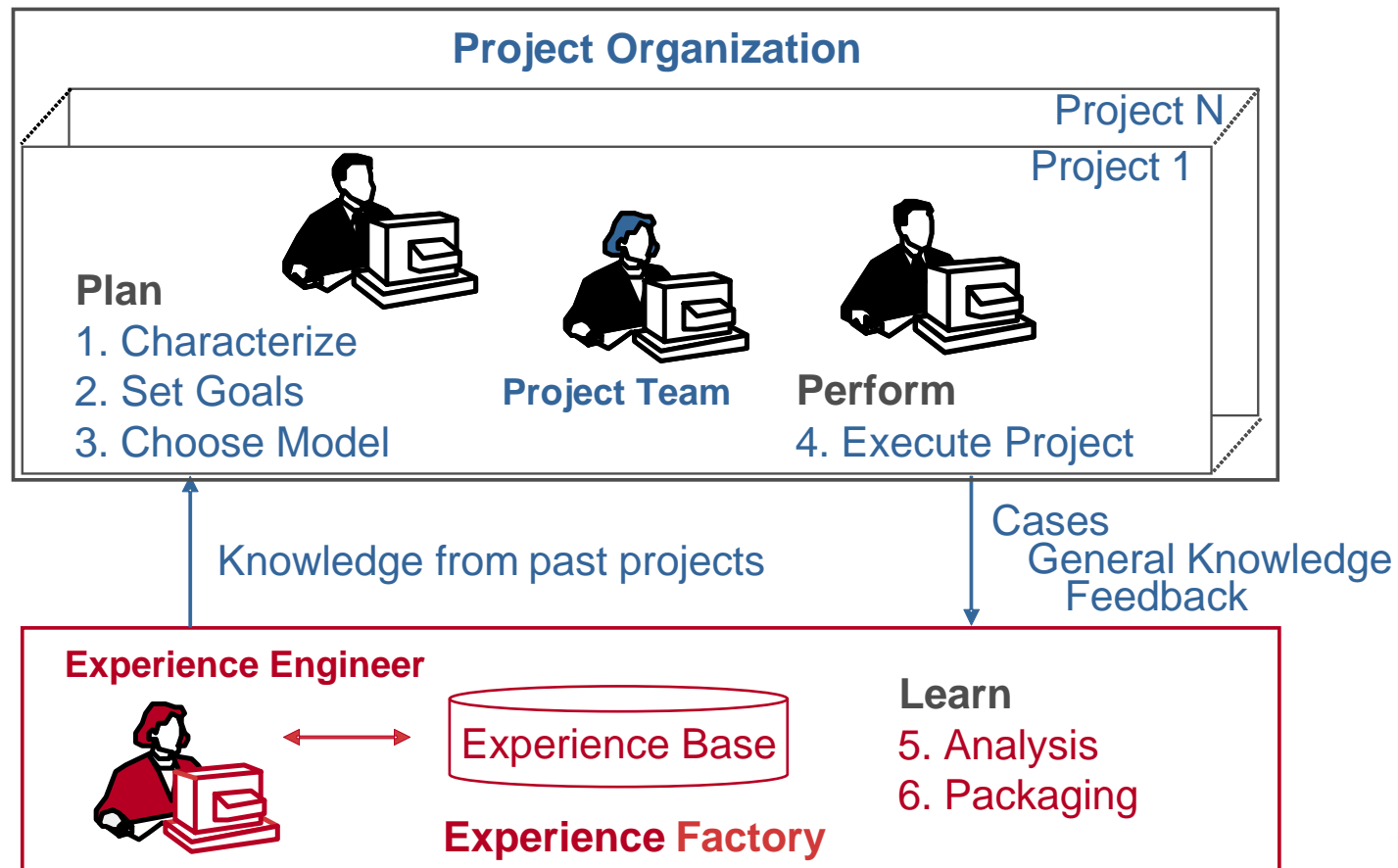
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Überblick

- Experience Factory (EF)
- Case-Based Reasoning (CBR)
- Integration von EF und CBR (DISER-Methode)
 - Ergebnisse (Dissertation Carsten Tautz 2001)
- Weiterentwicklung (Erfahrungsbasierte Informationssysteme; EbIS)
 - Ergebnisse (Dissertation Markus Nick 2005)
- Ausblick
 - Arbeiten an der Universität Hildesheim
 - teilweise in Kooperation mit dem Fraunhofer IESE

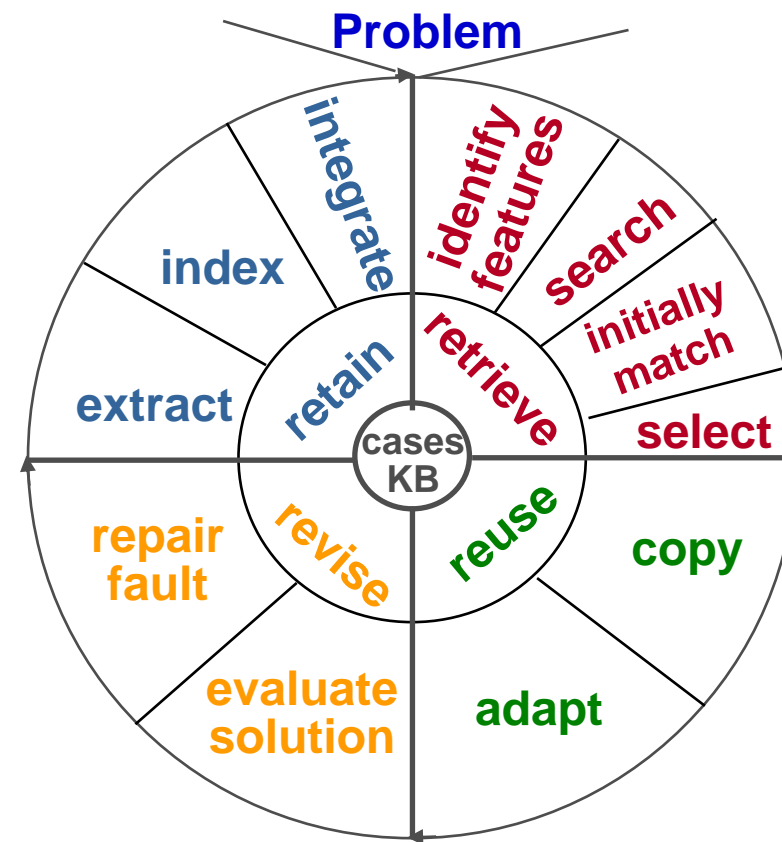
Experience Factory (EF)



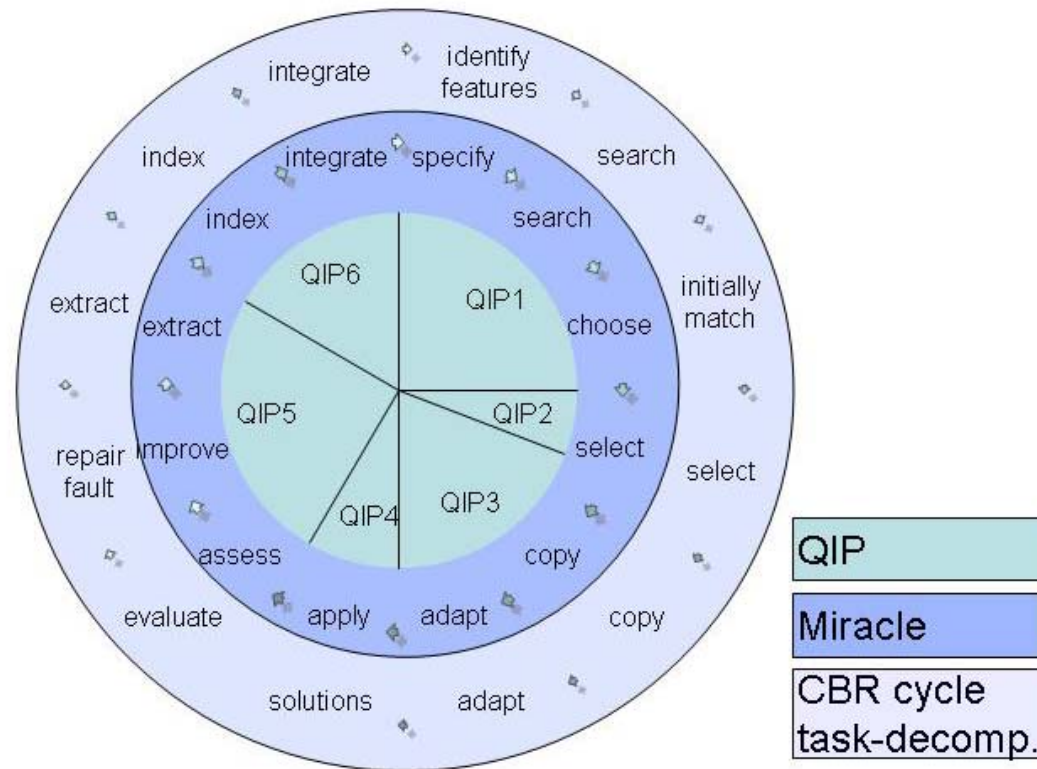
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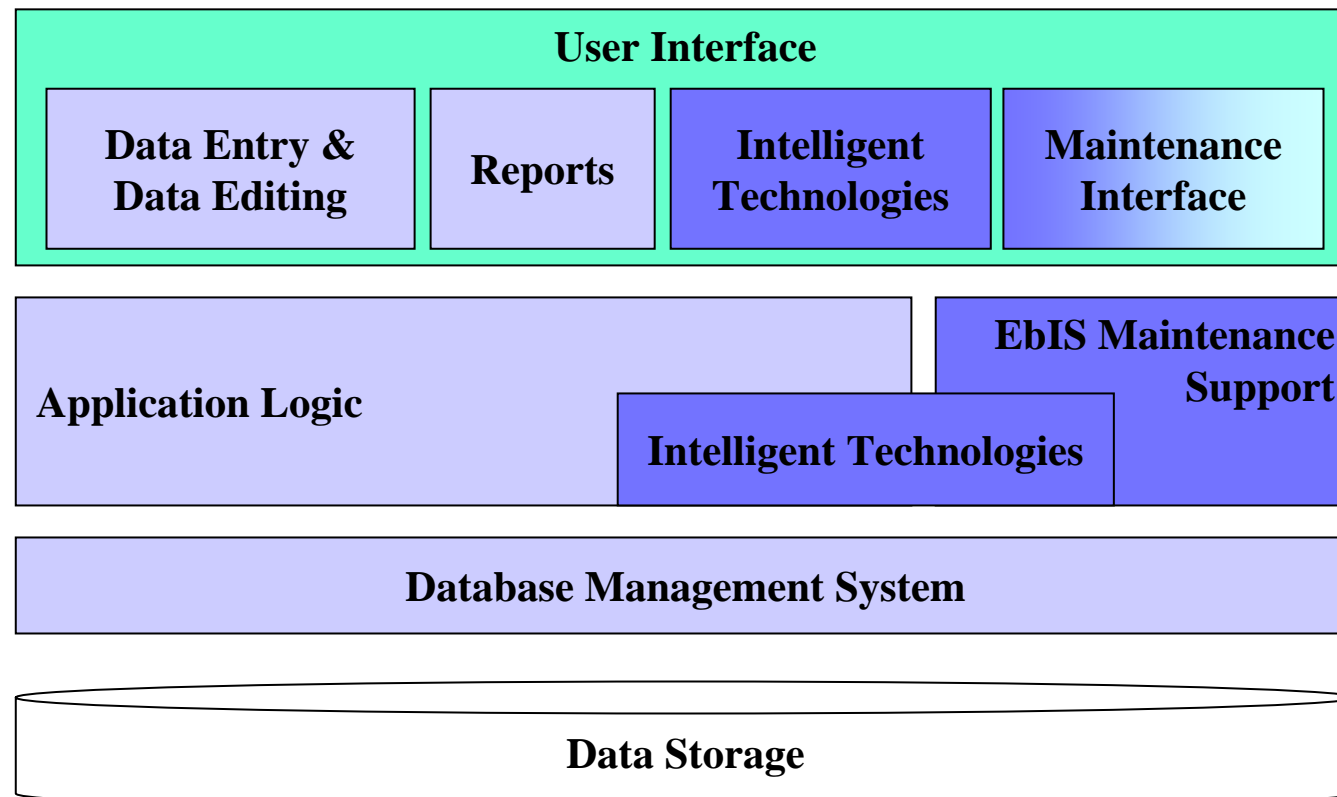
Relating CBR and EF/QIP



Evaluation – Experimental Results*

- EbIS approach («Using the EbIS») versus human-based approach («Talking to colleagues»)
- The experiment showed:
 - **Efficiency:**
 - The EbIS approach finds more useful guidelines and observations per time period (in terms of both effort and duration).
 - **Effectivity:**
 - The EbIS approach finds useful guidelines and observations not obtained by the human-based approach.
- The experiment validated this in a statistically significant way.
 - **Result:**
 - **Combine human-based and EbIS approach**
- The participants agreed: 28 out of 29 participants would apply both approaches in combination.

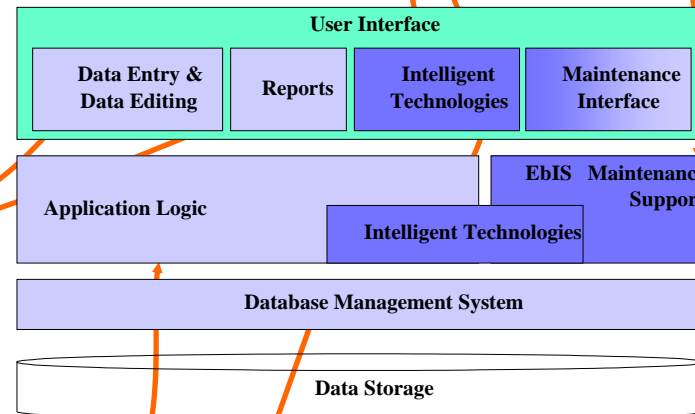
EbIS-Product-Line Architecture



- Legend:
- Special EbIS tools (dark blue)
 - “Traditional” tools/systems/infrastructure (light purple)

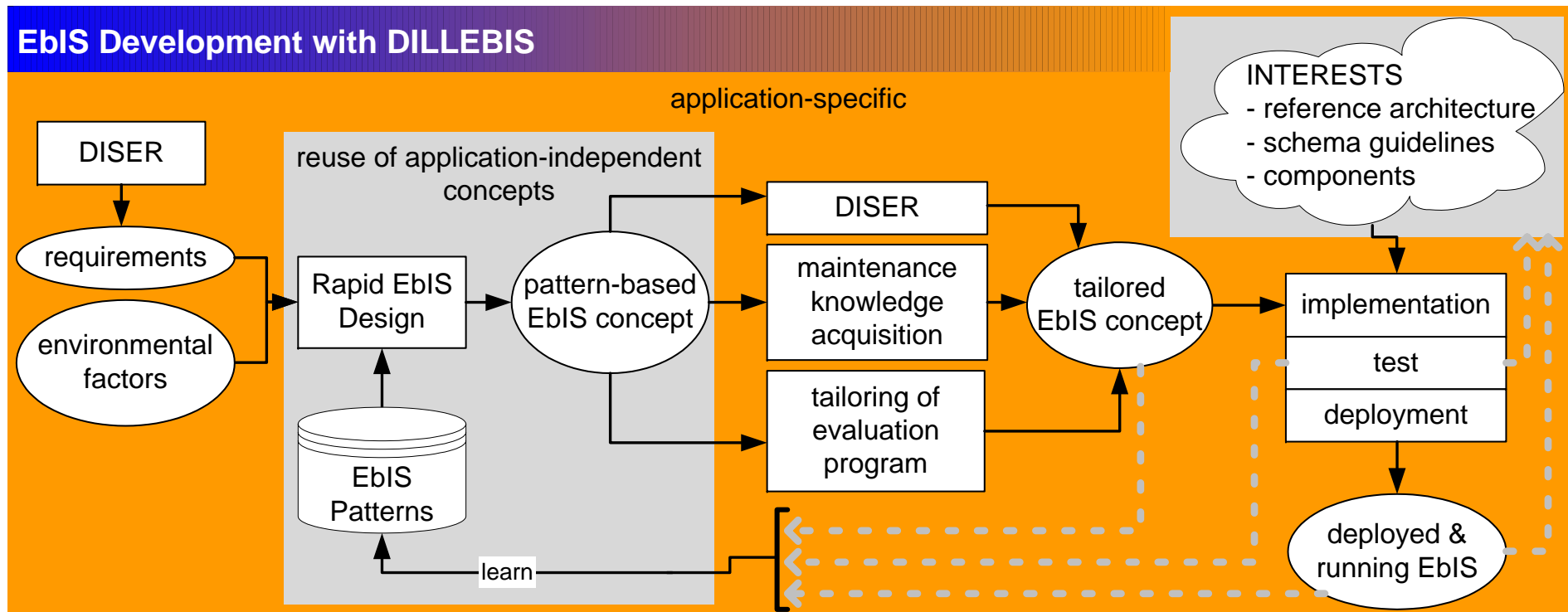
Components of EbIS Product-Line

- Intelligent Search
 - RAISIN/1 (IESE)
 - RAISIN/3gta (IESE)
 - Orenge (COTS from empolis)
- Browsing
 - TaxBrow – Taxonomy Browser (IESE)
 - ModelExplainer (IESE)
- Aggregation
 - Context Aggregator (IESE)
- Data Entry, Editing, and Reports
 - J2EE-based technology
 - Microsoft Access (cheap COTS)
 - Eclipse IDE plugins
 - Microsoft dotNET IDE plugins [planned]
- Server/Container
 - Apache Tomcat as J2EE container (open source)
 - IBM's Eclipse as Integrated Software Development Environment (open source, Java)
 - *Microsoft Access*
 - Microsoft dotNET [planned]
- Maintenance Support
 - EMSIG tools for evaluation and maintenance



- Data Base Management System
 - Microsoft Access (cheap COTS)
 - MySQL (open source)
 - PostgreSQL (open source)
 - Microsoft SQL Server
 - Oracle (high-end solution)

EbIS Development Process



Evaluation - Applicability within Projects

- **Broad applicability of EbIS method/tool** := Occurrence in successful EbISs in real-world projects
 - EbISs of different size and project type (→ “breadth”)
 - EbIS successful
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 - Status „deployable“ and EbIS tightly integrated
 - **Assumption** for tight integration: Acceptance and correct usage of the tool that supports the business process

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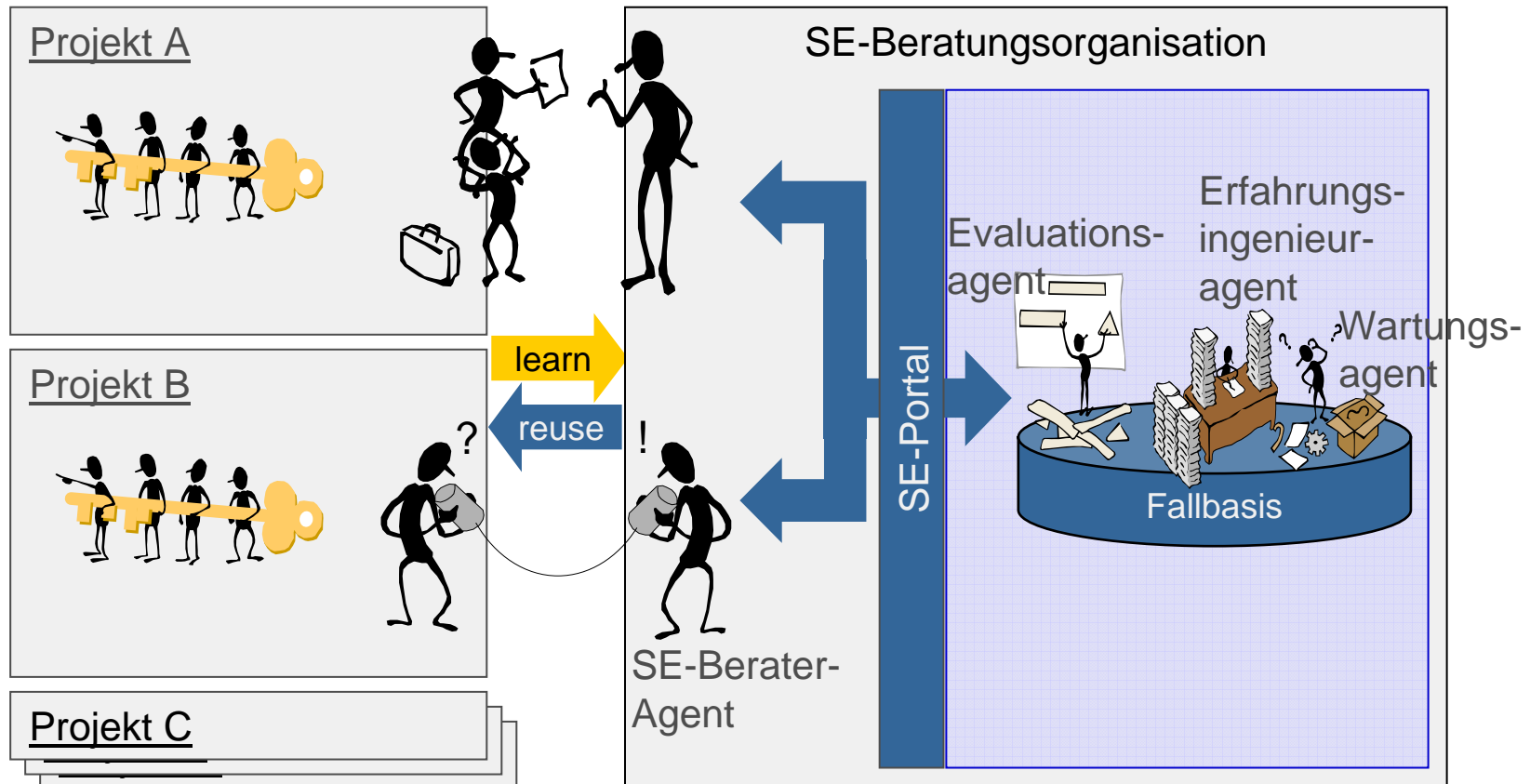
Nutzen

- Prototypische Realisierung von EF/EB mit CBR-Technologie
- Entwicklung einer systematischen, umfassenden Methode zur Entwicklung von EF/EB (DISER)
- „Technologieabstraktion“: EbIS
 - Einbeziehung alternativer und weitergehender Technologien
- Organisatorische Einbettung von CBR-Systemen in Industrie und Verwaltung
- (Zielorientierte) Evaluation und Wartung von CBR-Systemen

Ausblick

- Nutzung detailliert beschriebener Methoden (DISER/DILLEBIS) zur (teilweisen) Automatisierung solcher Prozesse
 - Beispiel: Intelligente Informationssysteme für Anwendungen im Ambient-Intelligence-Bereich
- Ziel: Integration von EF/CBR mit Software-Produktlinien (SPL)
 - Fokus auf „Wissen“
 - Nutzung von Agententechnologie zur Modularisierung auf der Wissensebene
 - Realisierung von einzelnen Agenten als EF/CBR-System
 - SPL als (hierarchische) EF solcher EF/CBR-Systeme
 - Beispiel: Simulation von Unternehmensgründungsprozessen mit Multiagentensystemen

Softwareagentenbasierte EF



Benefit - Case Study with Students*

- **Ziel:** Evaluation der initialen Konzepte der EbIS-Entwicklungsmethode
- Zwei Rollenspiele mit jeweils sieben Studenten mit nahezu identischem Design
 - weitere Rollenspiele mit ähnlichem Design in anderen Semestern
- **Rollenspiel:**
 - **Kontext:** Organisation zur Entwicklung von CBR-Anwendungen (X-CBR)
 - Situation und Historie zu X-CBR
 - **Aufgabe:**
 - Das X-CBR-Management entscheidet, dass eine Experience Factory über CBR-Projekte aufgebaut werden soll, um das Wissen zur Kernkompetenz „CBR-Anwendungen“ besser managen zu können
 - Übernahme der EF- und Organisationsrollen durch Dozent, Mitarbeiter und Studenten
 - Initiale Modellierung des EbIS
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- **Ergebnisse:**
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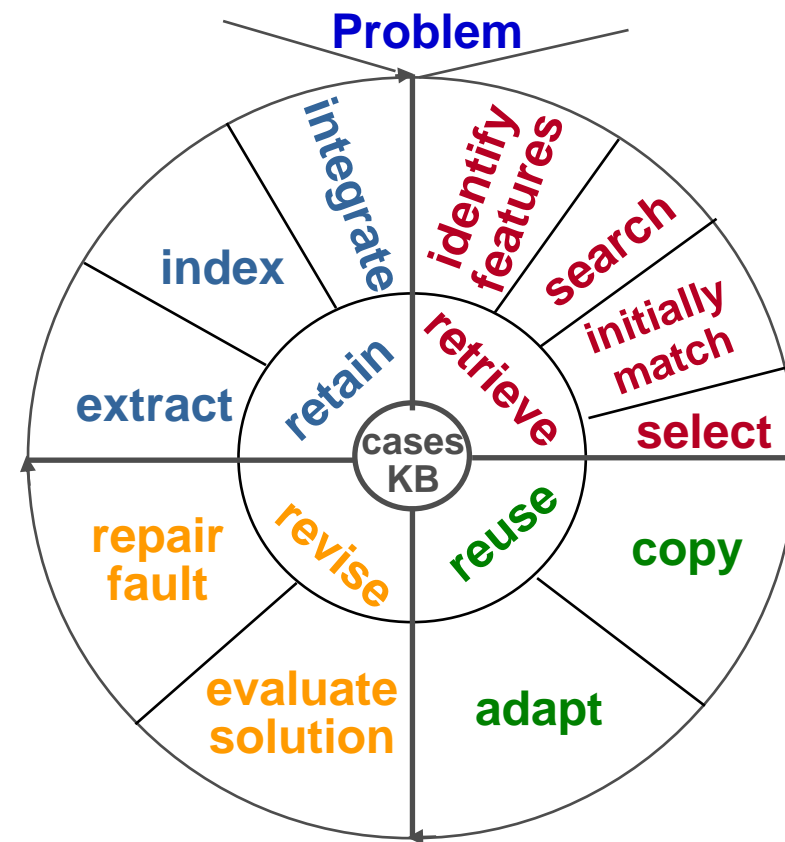
Overview

- Case-Based Reasoning (CBR)
- Experience Factory (EF)
- Integrating CBR and EF:
 - DISER method
 - Evaluation of DISER
 - Improvement of DISER: DILLEBIS method
 - Evaluation of DILLEBIS
- Benefits
 - from an SE perspective
 - from an AI perspective
- Implications and Outlook

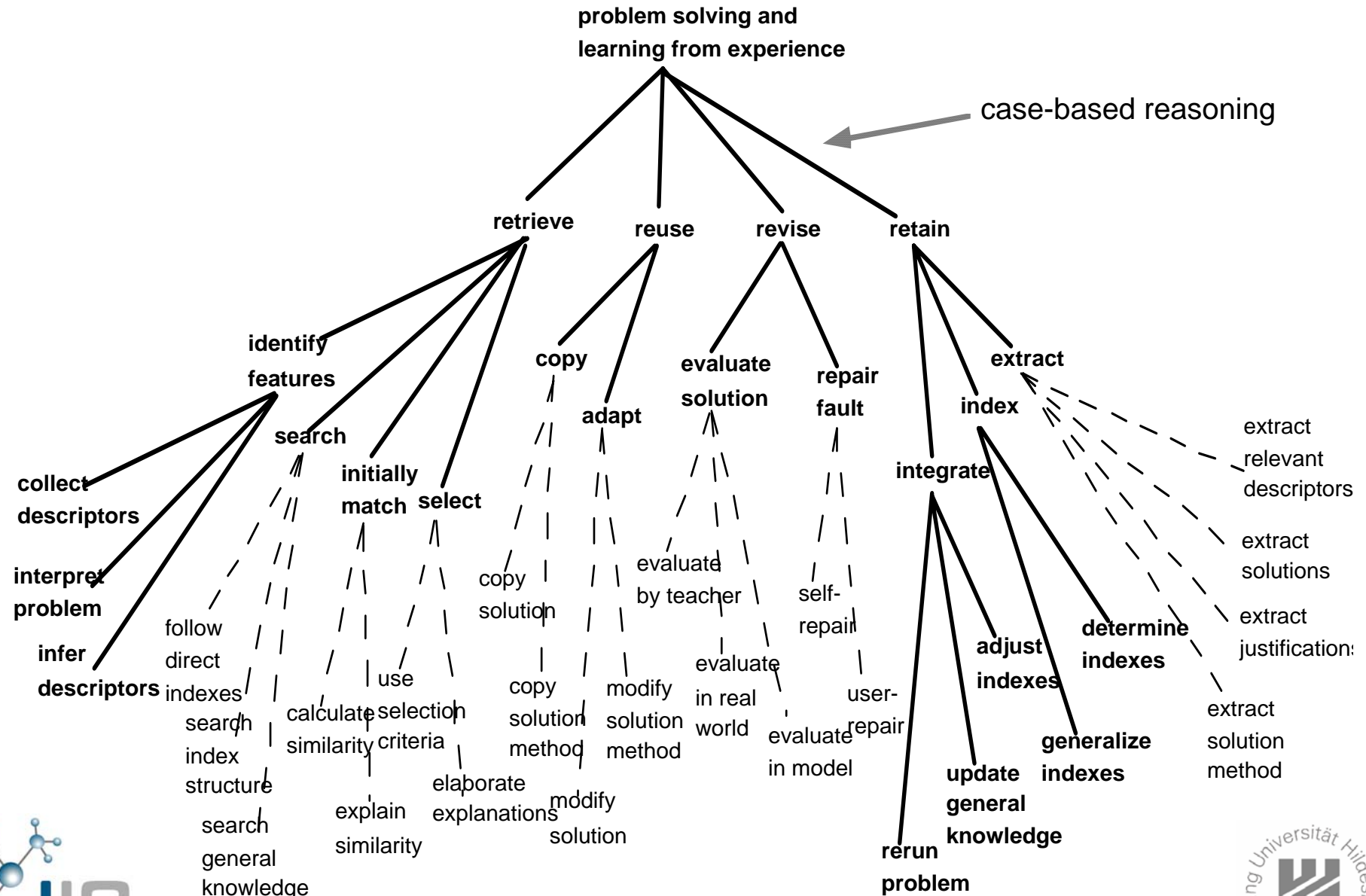
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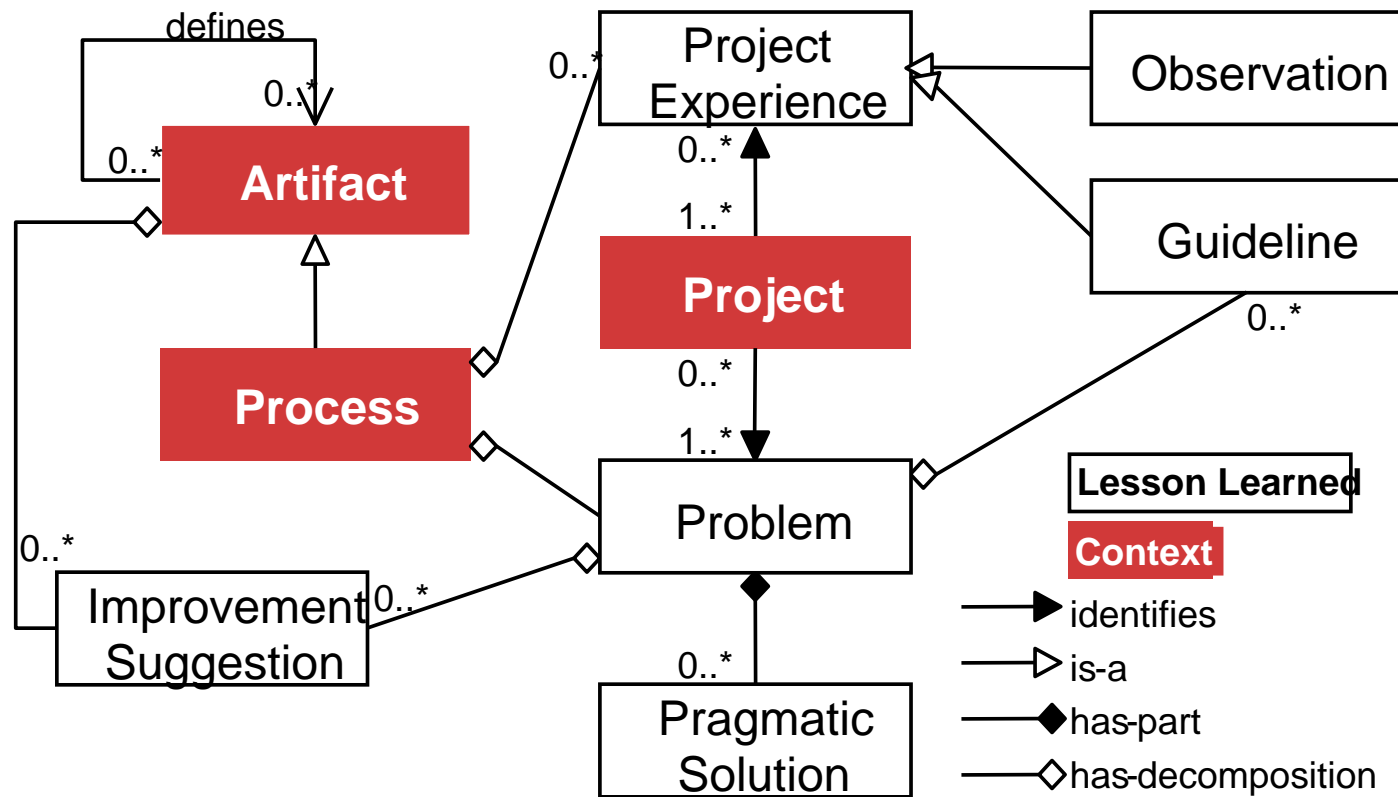
CBR Task-Method Decomposition Model



Abstracted Method for the **Retain** Task

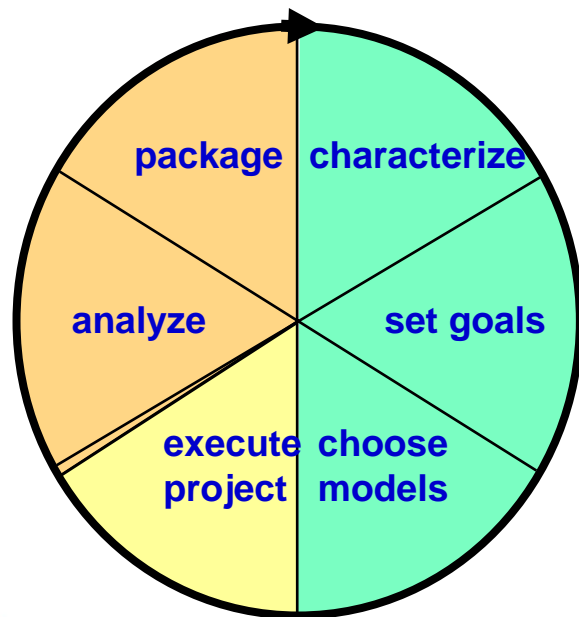
```
IF no_similar_past_case (current_case)
    THEN construct_new_case;
    ELSE lazy_generalise (old_case);
IF current_case_successful
    THEN integrate_into_successful_cases;
    ELSE integrate_into_total_problem_cases;
DO adaptation UNTIL system_behaves_as_wanted
```

Case Ontology for IESE Experience Factory

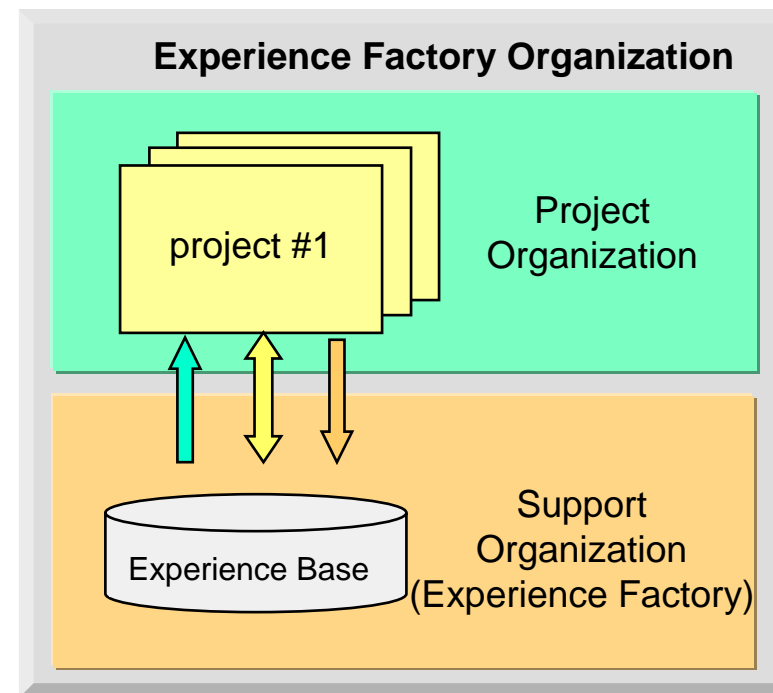


Experience Factory (EF) and Quality Improvement Paradigm (QIP)

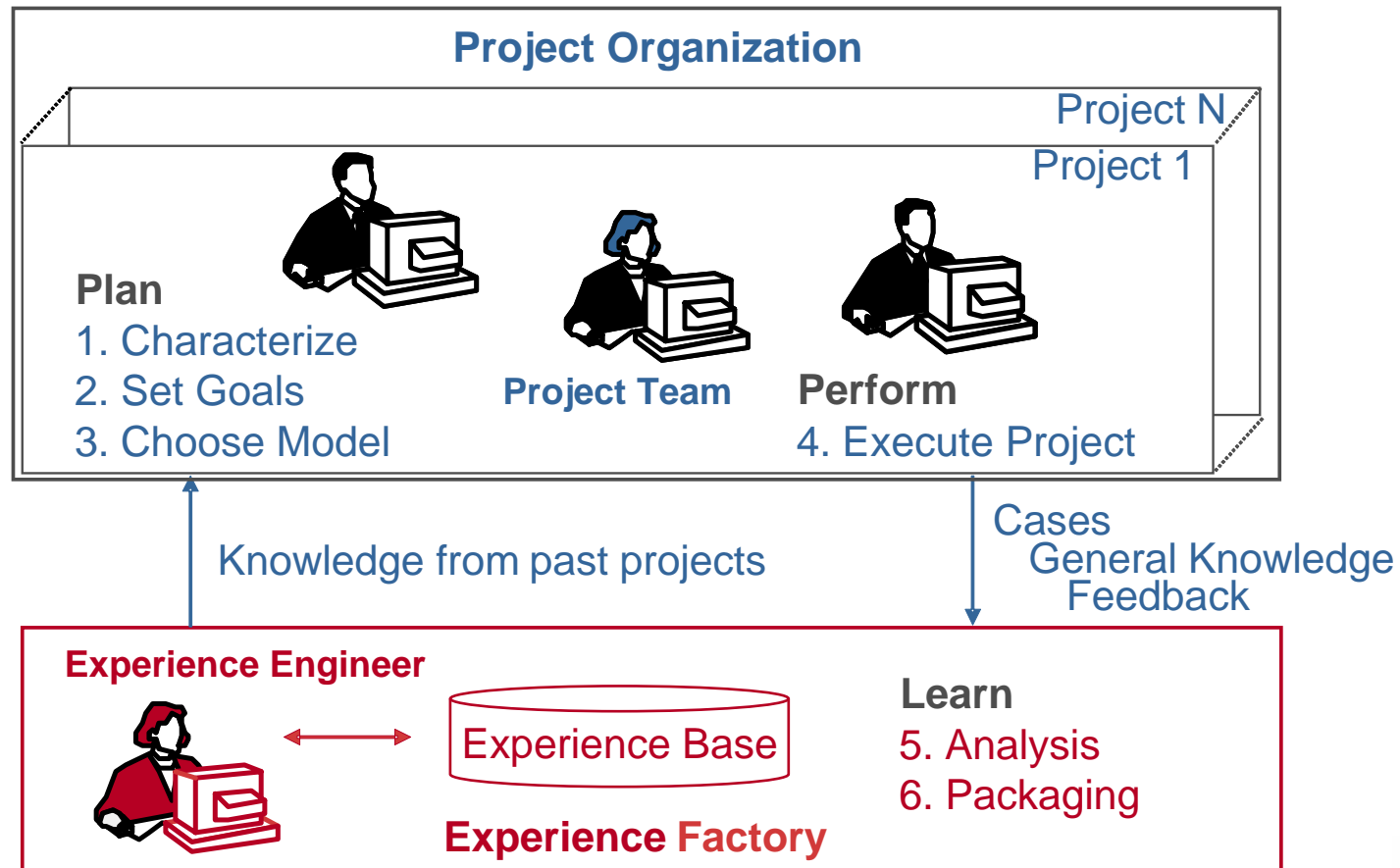
Quality Improvement Paradigm
(Basili, Rombach, 1988)



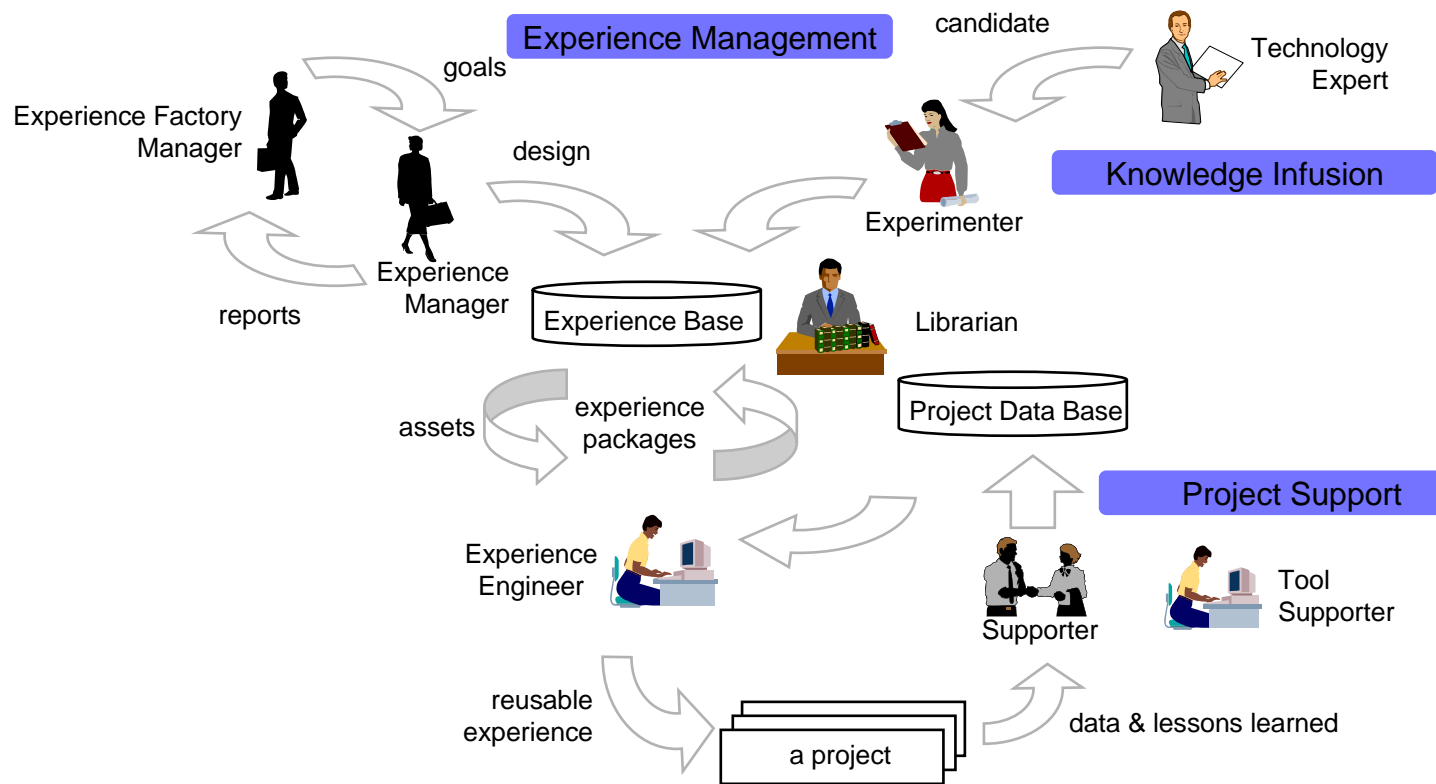
Experience Factory Organization
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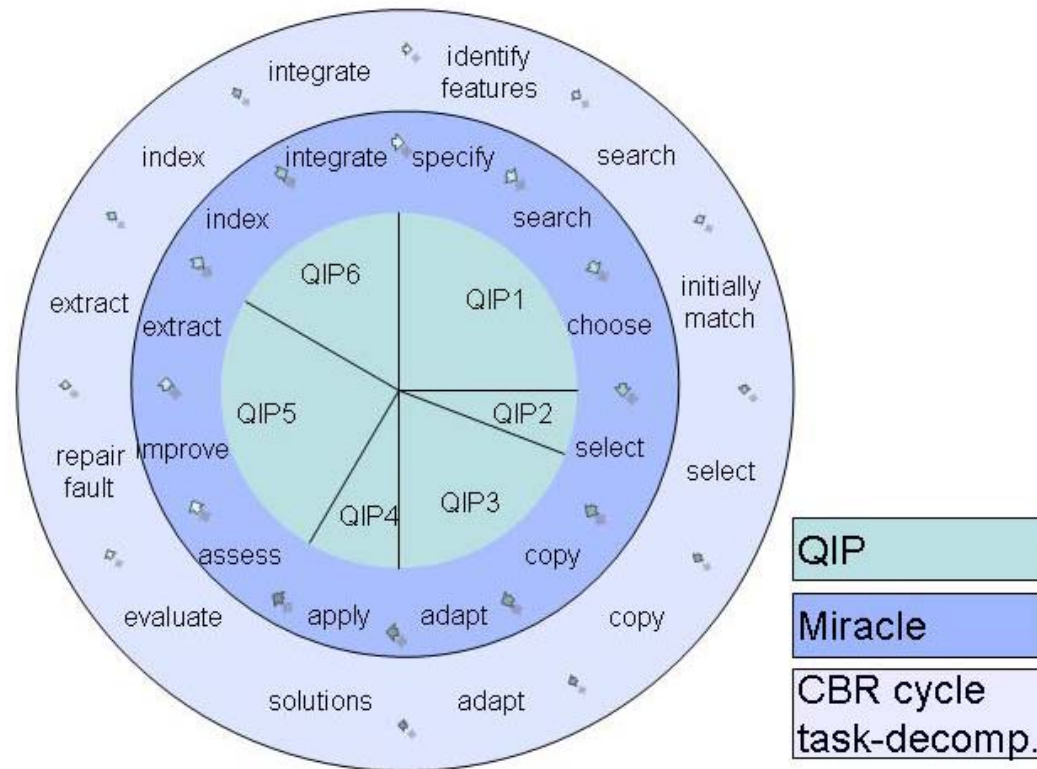


Experience Factory Roles

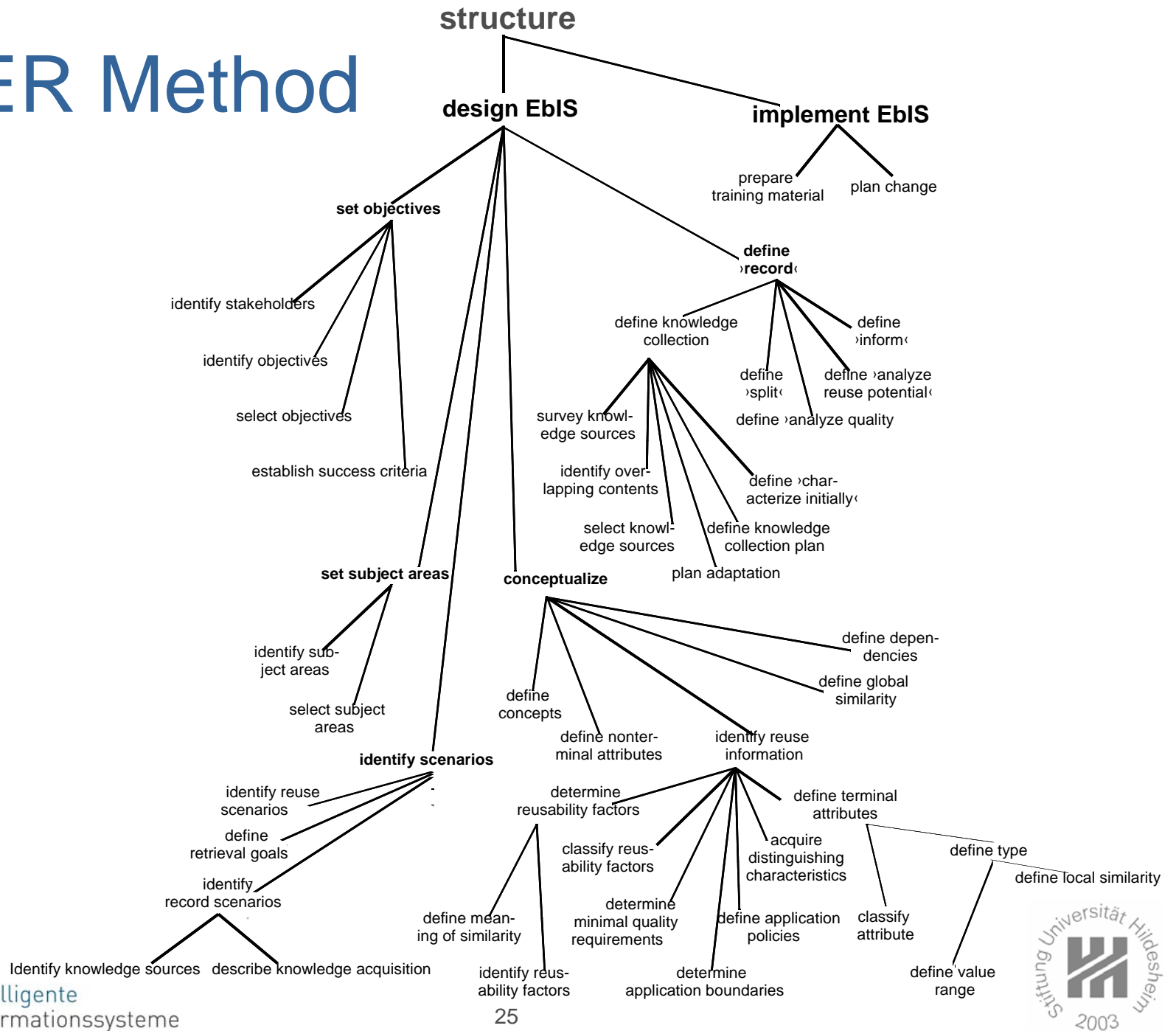


**Consolidated
description of
eight different
EF roles**

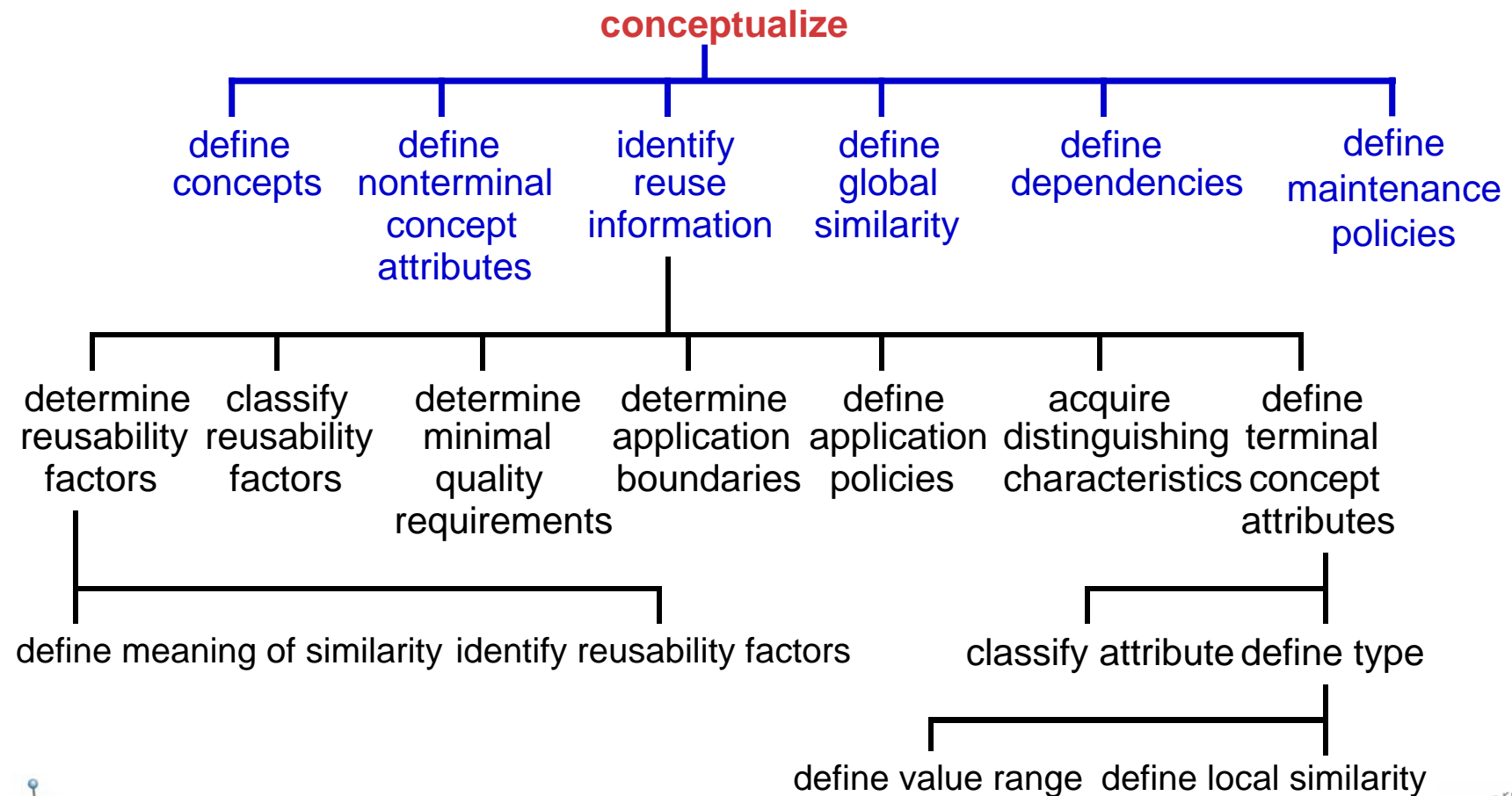
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DISER Method



EbIS Aufgaben & Methoden: Conceptualize



Conceptualize (1)

- **Goal:** Conceptualization of EbIS content
- **Input:** Reuse scenarios
- **Output:**
 - Schema of EbIS (conceptual model in the sense of structure based CBR)
 - Feedback indicators
 - Minimal quality requirements for reuse
 - Processes for reuse

Conceptualize (2)

- **Decomposition:**
 - Define concepts
 - Define nonterminal attributes
 - Identify reuse information
 - Define global similarity
 - Define dependencies
 - Define maintenance policies
- **Method:** Subtasks are carried out sequentially or iteratively.

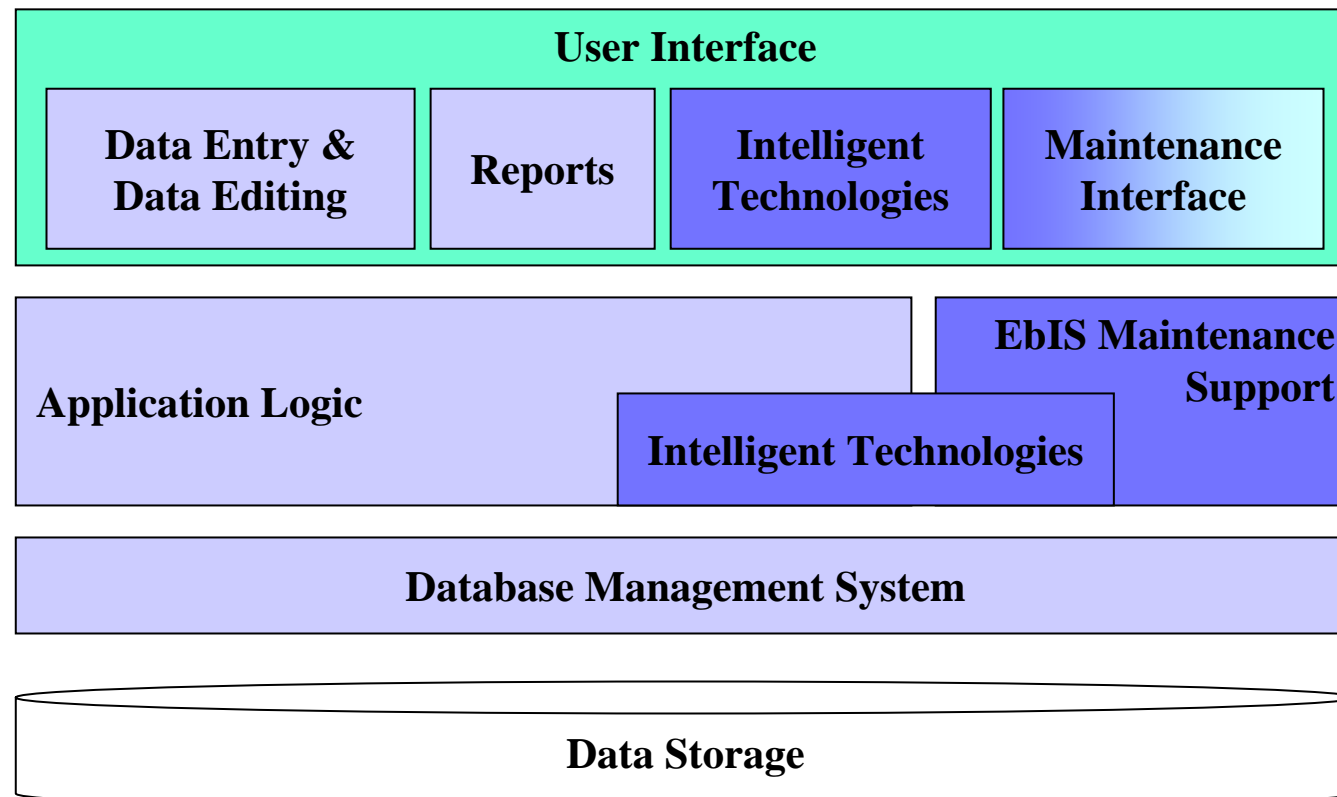
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Deficiencies of DISER

- **phase models and development strategies for a better integrability on the software process side;**
- solutions for “feedback loops” as well as experience life cycle models;
- solutions for relating different types of knowledge/experience each represented on a different level of granularity;
- **rapid application development approaches for a „cheap start“;**
- knowledge modeling approaches/guidelines for “scaling up”;
- scalability of the underlying knowledge technology;
- integrability of knowledge technology with traditional software system technology;
- supporting maintenance as a knowledge-intensive task;
- maintenance process;
- decision support for maintenance;
- acquisition method for maintenance knowledge;
- maintenance enactment support (for optimizing the maintenance process);
- business goal oriented method for running an EbIS;
- relating maintenance to the goals of an EbIS to guide maintenance with evaluation;
- availability of an evaluation plan and maintenance knowledge already for the beginning of regular use for handling the to be expected continuous stream of experience.

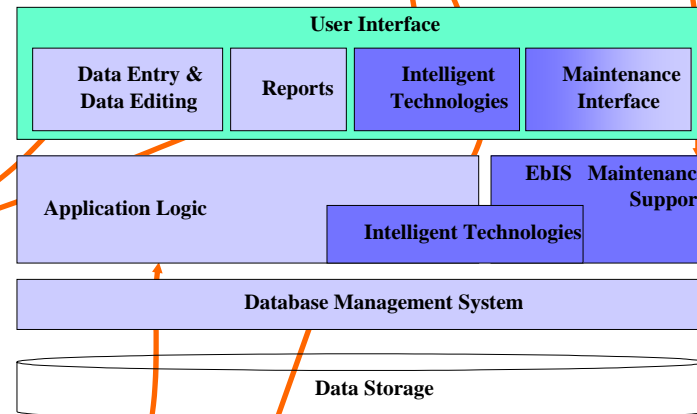
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Benefits

- Benefits from SE perspective
 - Prototyping a solution for EF
 - Developing DISER based on this prototype
 - Abstracting/generalizing from CBR systems to EbIS
 - ...
- Benefits from AI perspective
 - Evaluation approach for CBR/KBS
 - Real-life method: used and integrated into the work process
 - Need for additional AI techniques
 - ...

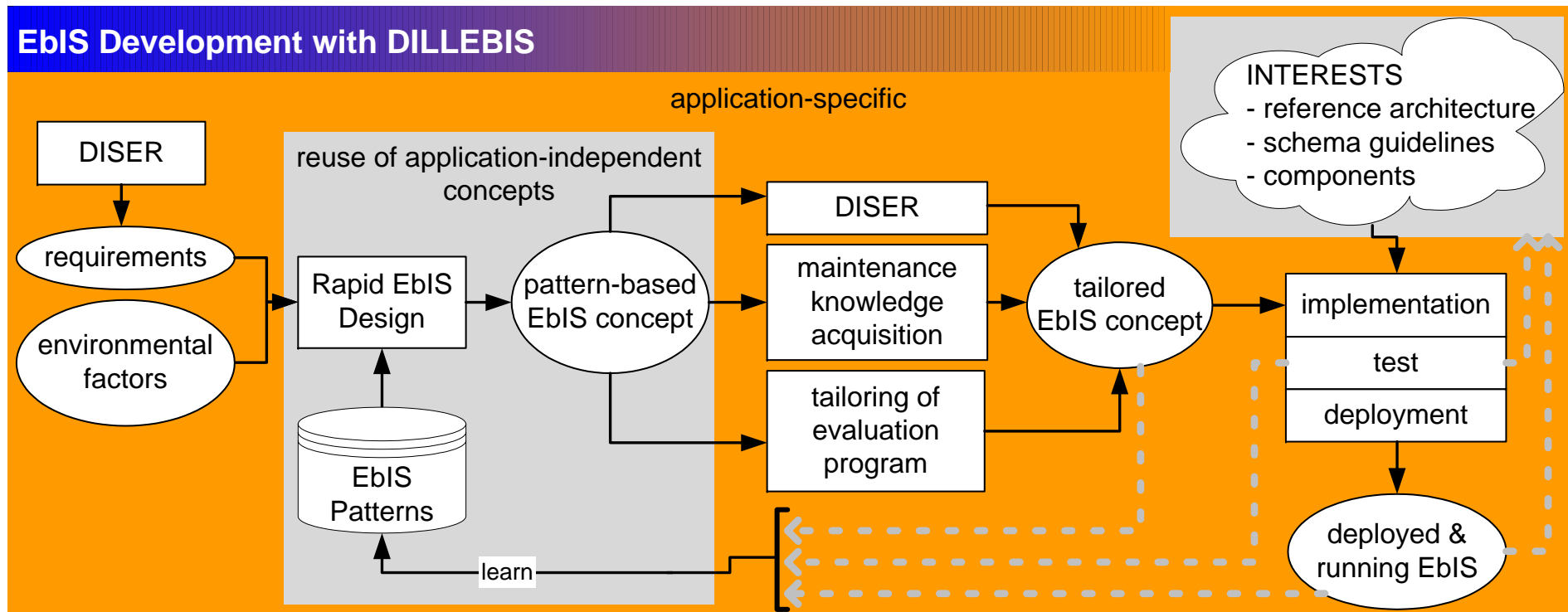
Implications and Outlook

- Integration of
 - Multi-agent systems
 - CBR
 - EF
 - Software product-lines
- Building intelligent information systems for supporting Ambient-Intelligence-like scenarios

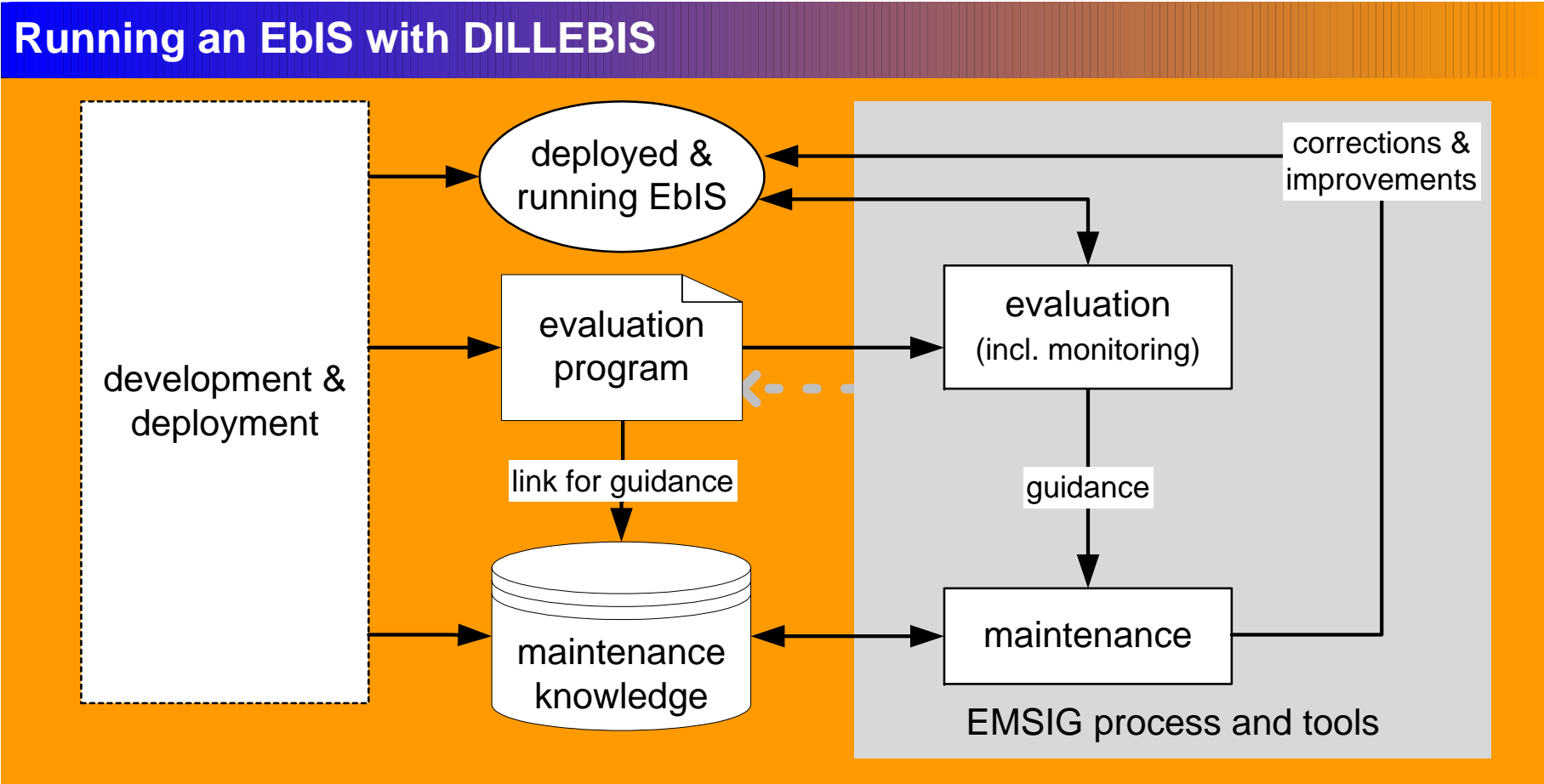
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EbIS Development Process



Running an EbIS



Research Areas in AI and SE and Their Intersections

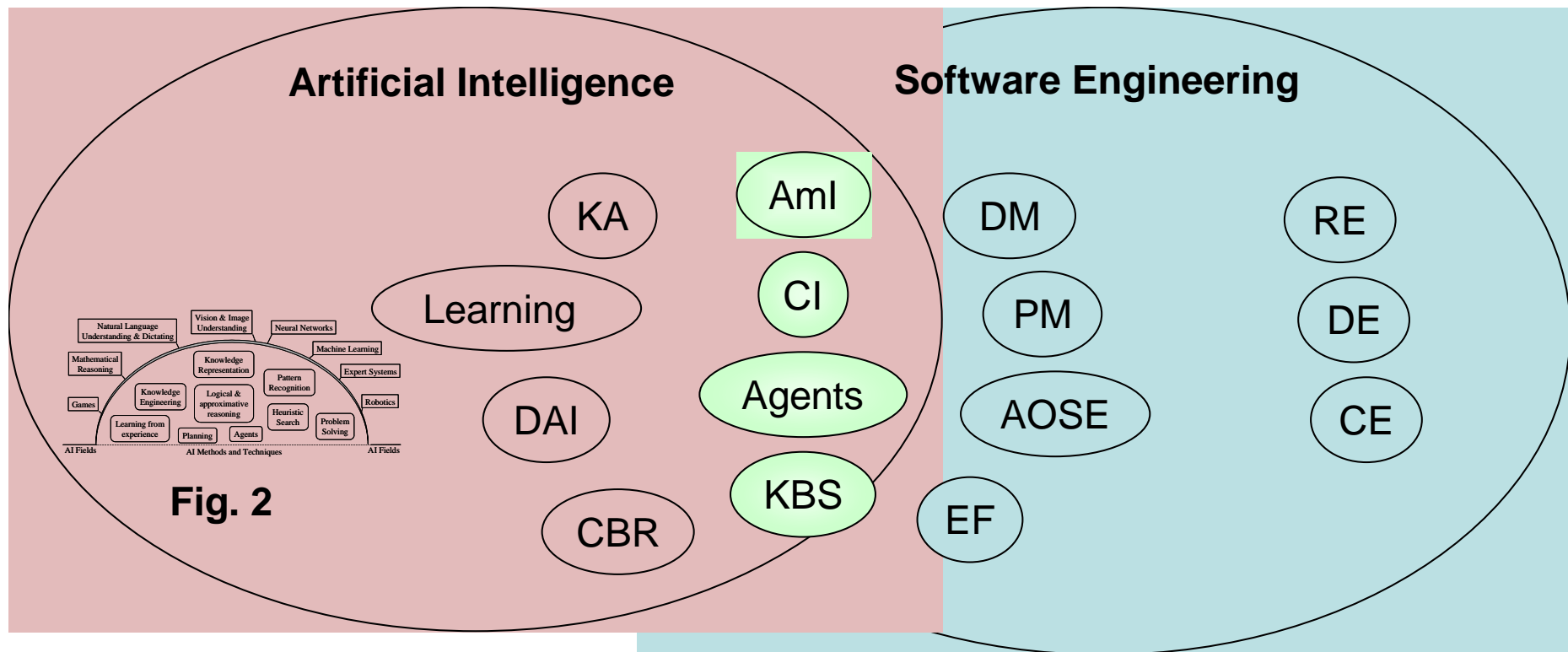


Fig. 2

EF Roles

- The **manager** provides resources, defines strategic goals and initiates improvement programs.
 - He determines the structure and content of the case base and controls its quality.
- The **supporter** is responsible for documenting new experiences and supporting the project team.
 - He collects and qualifies artifacts from the projects in accordance with the reuse criteria and the goals of the engineer.
 - Upon request, he supports the project team in retrieving and modifying the experience knowledge.
- The **engineer** is responsible for packaging and analyzing existing experiences.
 - Together with the manager, he identifies new reuse criteria and, based on that, acquires new cases.
 - He analyzes the case base in order to detect (further) improvement potential.
- The **librarian** is responsible for technical aspects like setting-up and maintaining the case base, storing, and publishing new cases.