Agile Development in Cloud Computing Environments (Project)

Information Technology (M.Eng.)

Module 11: Optional Technical Subject

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Dr. Patrick Wacht (email: patrick.wacht@fb2.fra-uas.de)

Frankfurt University of Applied Sciences, Frankfurt a. M., Germany

Aims and objectives of the course

By the end of this course, students will be able to:

- Apply **agile project management methods** to structure and execute software development projects collaboratively.
- Experience and reflect on **team-based development** under realistic conditions, including planning, coordination, and iterative delivery.
- Design and implement **software systems with complex requirements**, addressing aspects such as workflow logic, integration, and scalability.
- Develop the ability to **quickly adapt to learn new technologies**, frameworks, and tools relevant to modern enterprise software engineering.
- Demonstrate **problem-solving and analytical thinking skills** in handling open-ended real-world project scenarios.
- Critically asses and compare **different technological approache**s (e.g. custom implementation vs. workflow or low-code platforms).

Project technology variants

Individual [a]

- Free selection of programming language, database and frameworks to implement project task.

Camunda [b]

- Open-source platform for workflow and decision automation.
- BPMN-focussed and based on Java.
- Lightweight and developer-friendly with Java and REST API support.
- Widely used in the field of banking and insurance.
- Docs

Flowable [c]

- Open-source BPM (Business Process Management) engine
- Execution and monitoring of business processes using BPMN 2.0
- Java-based
- Supports complex workflows and human-task coordination
- Scalable und suitable for microservice architectures
- Docs

Pega [d]

- Low-code application development for building enterprise-grade applications.
- Enables fast development with less coding
- Built-in support for workflows, UI, data integration and decision logic.
- Pega Infinity Trial can be used (re-registration required)
- Docs

Project technology variants

Furthermore, there will be three groups who will build reports with:

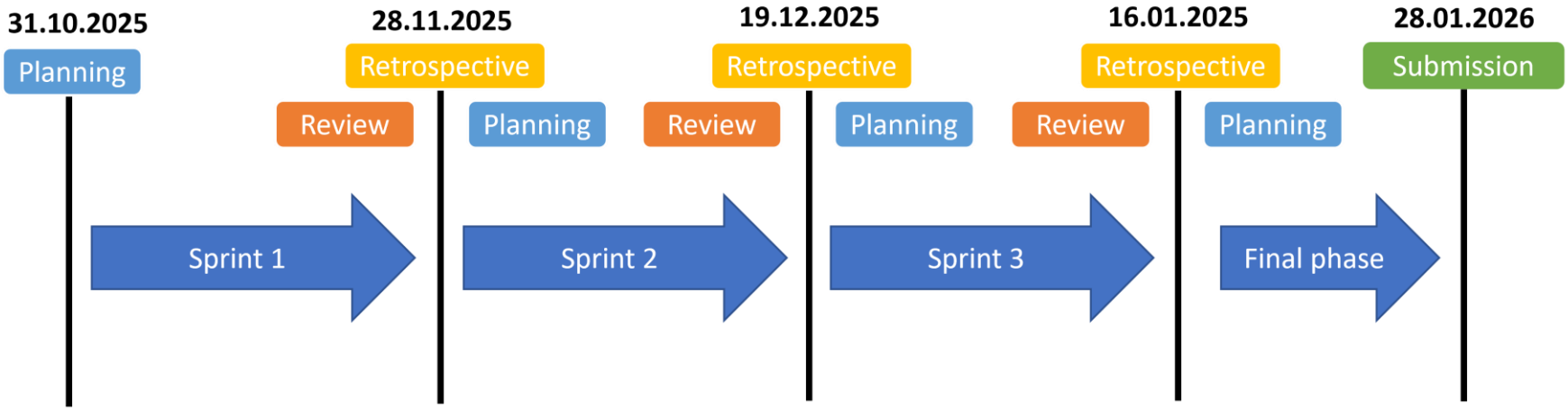
- Microsoft Power BI
  - Business Analytics & Dashboards
  - Strong integration with Excel, Azure and Microsoft365
  - Free desktop version for students
- Tableau
  - Visual analytics & data storytelling tool
  - Drag-and-drop dashboard creation
  - Widely used in industry & education
- Apache Superset
  - Open-source BI and data visualization platform
  - SQL-based dashboard creation
  - Good for technical users and customization

Important dates

24.10.2025	Presentation of the available topics
27.10.2025	End of withdrawal period
31.10.2025	Lecture „Agile Methods“ and start of Sprint 1
28.11.2025	Review, Retrospective Sprint 1 and Planning Sprint 2
19.12.2025	Review, Retrospective Sprint 2 and Planning Sprint 3
16.01.2026	Review, Retrospective Sprint 3 and final planning
28.01.2026 (eob)	Submission of the project (source code, project report)
30.01.2026	Presentation of the results (max. 15 minutes for each group)

Important:
In the lectures, we will apply agile methodologies such as plannings, reviews and retrospectives (next slide). We will also regulary have a look at the Kanban boards to learn how you plan the work packages.

Agile planning



General requirements

- Every student in the course has to select a project.
- Selection of project enabled via Moodle course.
  - Start: 24.10.2025, 6pm
  - End: 27.10.2025, 6pm
- There is a maximum number of students predefined for each selectable project.
- For the project, each group has to apply methods of SCRUM such as:
  - Attending Scrum meetings, e.g. Sprint planning, Sprint review and Sprint retrospective
  - Meetings do not have to take place during the lecture, but they need to be documented in the report.
- Different kinds of technologies are predefined for each project. For individual developments and also for predetermined technologies, Microsoft Azure can be used as cloud platform.
- Be aware that some projects are depending on each other. Communication has to take place within the team and with the other teams.

Software project report

- The submission should include the source code (zip-Archive) and the software project report as PDF document.

- Requirements regarding software project report:
  - Minimum of 12 pages
  - Must include how the Sprints have been planned (based on user stories, Kanban boards, documentation of results)
  - Must include how agile principles have been applied. Critical appraisal should take place answering the following questions based on your experience:
    - How did you manage to apply SCRUM as agile methodology? (e.g. Scrum meetings, Scrum roles…)
    - How have you applied the push and pull principle?
    - How did you measure complexity of tasks?
    - How did you collaborate with the customer?
    - What is the opinion of the team regarding agile principles?
  - Must include how the project has been implemented (class diagrams, data base models, interfaces to other projects…).
  - Must include comparison of technologies for same project.
  - Must include a conclusion.

Presentation of the project results

- Each group will have up to 15 minutes to present the results.
- Demonstration of the working prototype.
- Architecture and implementation
- Critical appraisal and comparison of technologies.

Project evaluation and grading

- 70% Project result (incl. Architectures, implementation and completeness of requirements)
- 20% Critical appraisal on the use of agile principles, use of agile methods such as Kaban board and comparison of technologies.
- 10% Project presentation with possible questions

Project overview

The company „FraUAS“ wants to build a new IT landscape for a better and more efficient use of their internal resources as well as good collaboration with their providers. The following features are planned:

1. **Workforce planning tool (Groups 1a, 1b, 1c, 1d)**
2. **Contract Management tool (Groups 2a, 2b, 2c, 2d)**
3. **Service Management tool (Groups 3a, 3b, 3c, 3d)**
4. **Provider Management tool (Groups 4a, 4b, 4c, 4d)**
5. **Reporting (Groups 5a, 5b, 5c)**

Groups 1a, 1b, 1c, 1d: Workforce planning tool

Overall Objective:

A digital workforce workflow system needs to be implemented that supports the internal assignment (disposition) of employees in a large company. The workflow should handle key steps such as:

- Requesting employees for a project or department
- Approval by supervisors
- Matching available employees based on skills and workload
- Confirmation and notifications for all involved parties

Personas:

- Project Manager
  - Needs to request staff for new or ongoing projects
  - Defines required qualifications, start dates and workload
  - Monitors approval and assignment progress.
- Department Head / Approver
  - Reviews staffing requests and approves or rejects them based on priorities and budget.
  - Wants transparency on how staff are distributed across projects.
- Resource Planner / Dispatcher
  - Searches for and assigns suitable employees.
  - Balances workload across teams.
  - Updates availability information in the system.
- Employee
  - Receives notifications about the new assignment.
  - Can confirm participation or raise scheduling conflicts.

Groups 1a, 1b, 1c, 1d: Workforce planning tool

Functional requirements:

- Request creation by Project Manager.
- Approval or rejection by Department Head.
- Assignment of employees by Resource Planner.
- Notification and optional confirmation by Employee.
- Clear process tracking of all personas.
- Make data in workflow reportable (→ Groups 5a, 5b, 5c).
- Make personas transparent throughout process (→ Groups 3a, 3b, 3c, 3d)
- Enable entry point for service management if there is no internal resource available (→ Groups 3a, 3b, 3c, 3d).
- Further specification takes place during collaboration with the customer.
- APIs need to be provided to other groups.

Group	Number of students	Technologies used
1a	5	Individual
1b	4	Camunda
1c	4	Flowable
1d	4	Pega

Groups 2a, 2b, 2c, 2d: Contract Management tool

Overall Objective:

A contract management system needs to be implemented that supports the negotiation and approval of contracts between a company and its external service providers (IT services). The workflow should handle key steps such as:

- Initiation and publishment of a contract request (should allow definition and storage of contract templates and structures for reuse)
- Receiving supplier offers
- Negotiating terms
- Final approval
- See provider quality based on established contracts.

Personas:

- Procurement Manager
  - Initiates new contract request.
  - Defines contract type, terms and target conditions
  - Tracks negotiation and approval status
- Legal Counsel
  - Reviews proposed contract drafts and supplier offers.
  - Ensures compliance with legal and corporate policies.
  - Approves or requests modifications before establishment.
- Contract coordinator (→ Groups 4a, 4b, 4c, 4d)
- Contract Administrator
  - Manages final document repository and contract metadata.
  - Ensures correct versioning and archiving of approved contracts.
  - Generates reports (SLA → quality of providers) on active and expired contracts.

Groups 2a, 2b, 2c, 2d: Contract Management tool

Functional requirements:

- Create contract request by Procurement Manager.
- Publish contracts and let providers offer submissions (through Contract coordinator) until deadline (→ Groups 4a, 4b, 4c, 4d).
- Enable negotiation loops for exchange of revisions until an agreement is reached (based on prices).
- Legal review with approval or modification by Legal Counsel.
- Make data in workflow reportable (→ Groups 5a, 5b, 5c).
- Make personas transparent throughout process (→ Groups 4a, 4b, 4c, 4d).
- Make initiated and established contracts transparent throughout process (→ Groups 3a,3b,3c,3d and Groups 4a,4b,4c,4d)
- Further specification takes place during collaboration with the customer.
- APIs need to be provided to other groups.

Group	Number of students	Technologies used
2a	5	Individual
2b	4	Camunda
2c	4	Flowable
2d	4	Pega

Groups 3a, 3b, 3c, 3d: Service Management tool

Overall Objective:

A service management system needs to be implemented that enables project managers within a company to request external experts when no suitable internal resource could be found through the internal workforce tool (Groups 1). The workflow supports:

- Request creation, initiation and publishing.
- Provider selection through evaluation process and external assignment confirmation.
- Tracking of ongoing service requests, provider responses and engangement outcomes.

Personas:

- Project Manager
  - Published request for internal resources (Groups 1).
  - Initiates request for an external expert.
  - Defines required skills, duration and project context based on active contracts (Groups 2).
  - Monitors provider responses and evaluates offers.
- Procurement Officer
  - Reviews and validates external service requests.
  - Ensures compliance and approves and rejects requests before publishing.
- Supplier Representative (→ Groups 4a,4b,4c,4d)
- Resource Planner
  - Evaluates incoming provider offers.
  - Coordinates final selection with Project Manager.
  - Updates the internal resource database once the external expert ist confirmed.

Groups 3a, 3b, 3c, 3d: Service Management tool

Functional requirements:

- Request initiation by Project Manager (role, skills, duration, project) based on contract (→ Groups 2a, 2b, 2c, 2d) and only possible if already published internal (Groups 1a, 1b, 1c, 1d).
- Internal validation through Procurement Officer and publishing of request.
- Receive offers from provider by Supplier Representative (Groups 4a, 4b, 4c. 4d).
- Evaluation of offers and selection by Project Manager verified by Procurement Officer.
- Tracking of requests, offers, decisions and confirmations.
- Finalise request until final order is complete.
- Make data in workflow reportable (→ Groups 5a, 5b, 5c).
- Make personas transparent throughout process (→ Groups 1a, 1b, 1c, 1d and Groups 4a, 4b, 4c, 4d).
- Further specification takes place during collaboration with the customer.
- APIs need to be provided to other groups.

Group	Number of students	Technologies used
3a	5	Individual
3b	4	Camunda
3c	4	Flowable
3d	4	Pega

Groups 4a, 4b, 4c, 4d: Provider Management tool

Overall Objective:

A provider management system needs to be implemented that enables external service providers to interact efficiently with the „FraUAS“ company through two main processes:

- Responding to service requests coming from the internal service management tool (Group 3a,3b,3c,3d).
- Managing contract offers and negotiations linked to the contract management tool.

Personas:

- Supplier Representative
  - Receives service requests from the company.
  - Submits offers or proposals including rate, availability and profile details.
  - Tracks the status of submitted offers.
- Contract coordinator
  - Manages contract-related negotiations.
  - Reviews contract drafts, proposes modifications and submits signed versions of counteroffers.
  - Ensures that contractual data are consistent with the provider‘s policies and services.
- Provider Admin
  - Maintains the provider‘s master data (organization profile, legal details, key contacts, certifications)
  - Updates information regularly to ensure compliance and visibility in company system.
  - Monitors data completeness and validity.

Groups 4a, 4b, 4c, 4d: Provider Management tool

Functional requirements:

- Receive new requests from the company‘s service management tool (Group 3a,3b,3c,3d).
- Display request details and allow offer submission (price, expert profile, delivery time, etc.).
- Receive draft or proposed contracts from the contract management tool (Group 2a,2b,2c,2d).
- Allow review, modification, and submission of counteroffers or signed agreements.
- Maintain history of contract versions and communication.
- CRUD functionality for provider profile with audit trail for data changes.
- Overview of submitted offers, contracts, and pending actions.
- Notification system for new requests or contract updates.
- Make data in workflow reportable (→ Groups 5a, 5b, 5c).
- Make personas transparent throughout process (→ Groups 2a, 2b, 2c, 2d and Groups 3a, 3b, 3c, 3d).
- Further specification takes place during collaboration with the customer.
- APIs need to be provided to other groups.

Group	Number of students	Technologies used
4a	5	Individual
4b	4	Camunda
4c	4	Flowable
4d	4	Pega

Project 5a, 5b, 5c: Reporting

Overall Objective:

A reporting system needs to be implemented that provides insights into key performance indicators (KPIs), enables management-level decision support, and allows flexible data analysis. It consolidates data from the company‘s operational systems – including:

- Workforce management tool
- Contract management tool
- Service management tool
- Provider management tool

Personas:

- Business Analyst:
  - Needs to monitor performance across workforce allocation, contract activity, and provider utilization.
  - Builds dashboards for management reports and ad-hoc analysis.
  - Ensures KPIs are consistent and meaningful across systems.
- Data Engineer
  - Responsible for integrating and transforming data from all systems.
  - Designs the data model and ETL processes.
  - Ensures data quality, security, and refresh schedules.
- Department Manager
  - Uses dashboards to understand staffing efficiency, contract timelines, and provider performance.
  - Requires high-level summaries and visual comparison across departments.

Project 5a, 5b, 5c: Reporting

Functional requirements:

- Data Integration
  - Import and consolidate data from the four systems.
  - Harmonize data formats and identifiers (e.g. employee Ids, provider Ids, contract Ids).
  - Maintain historical and current data snapshots.
- Data Model
  - Define a unified data schema.
  - Store facts and dimensions relevant for KPIs like:
    - Staffing efficiency
    - Contract cycle time
    - Provider response rates and ratings
    - External vs. Internal resource ration
    - Amount of expense and trends
- Reporting & Visualisation
  - Connect the system to a BI tool
  - Create interactive dashboards for each persona (Analyst, Manager)
  - Enable filtering, drill-down and export functionalities.
- Manage permissions for internal users.
- Further specification takes place during collaboration with the customer.
- APIs need to be provided to other groups.

Group	Number of students	Technologies used
5a	4	Tableau
5b	4	Power BI
5c	4	Apache Superset

Recommendations before you start

- First, initiate a meeting in your project group.
- Don‘t start coding before writing user stories!
- Don‘t start coding before having discussed about required APIs.
- Define data sets/data contracts for APIs.
- Identify interfaces between the projects.
- Define limitations for the overall project.

Topics for upcoming week

- Introduction in agile methodologies
- SCRUM
- Breakout sessions for groups for further specification and planning of Sprint 1