

Object Oriented Analysis and Design

Chapter 04: Object Oriented Software Development Methodologies

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Software Development Process

Unified Process

Software
Development
Process

Unified Process

Extreme
Programming
(XP)

A software development process (SDP), also known as a software engineering process (SEP), defines the who, what, when and how of developing software. SEP is the process in which we turn user requirements into software.

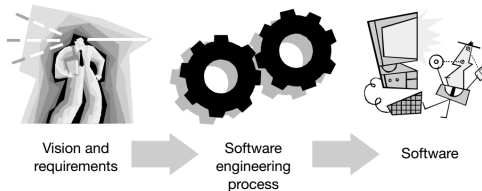


Figure: [1]

SDP & USDP

The Unified Software Development Process (USDP) is an industry standard SEP from the authors of the UML. It is commonly referred to as the Unified Process (UP).

UP & UML

The UML project was meant to provide both a visual language and a software engineering process. What we know today as UML is the visual language part of the project – UP is the process part.

UP History

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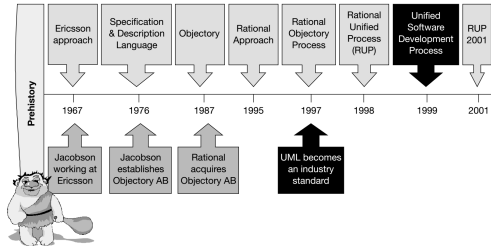


Figure: [1]

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RUP is a UP commercial variant that supplies all of the standards, tools, etc. that are not included in UP. It also provides a rich web-based environment including process documentation and “tool mentors” for each of the Rational tools.

- Both UP and RUP model the who, when and what of the software development process
- The main differences are those of completeness and detail rather than semantic or ideological matters
- At the beginning, RUP was just considered as a commercial implementation of UP
- The latest version of RUP (RUP 2001) has some terminological and syntactic differences to UP



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- **Use case and risk driven:** UP predicates software construction based on the analysis of risk
- **Architecture centric:** Quality system architecture will lead to a quality system
- **Iterative and incremental:** The iterative aspect of UP means that we break the project into small sub-projects (the iterations) that deliver system functionality in chunks, or increments, leading to a fully functional system



UP is an iterative and incremental process

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- Each iteration contains all of the elements of a normal software development project (analysis and design, construction, integration and test ,...)
- Each iteration generates a baseline that comprises a partially complete version of the final system
- The difference between two consecutive baselines is known as an increment



UP is an iterative and incremental process

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- Breaking the project down into a series of iterations allows a flexible approach to project planning
- Each iteration may include up to five core workflows(requirements, analysis, design, implementation and test)
- The emphasis on a particular workflow depends on where the iteration occurs in the project lifecycle



UP Structure

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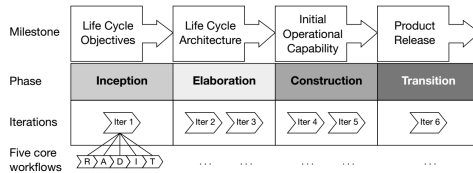


Figure: [1]

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- **Inception** Life Cycle Objectives
- **Elaboration** Life Cycle Architecture
- **Construction** Initial Operational Capability
- **Transition** Product Release



UP Phases vs Workflows

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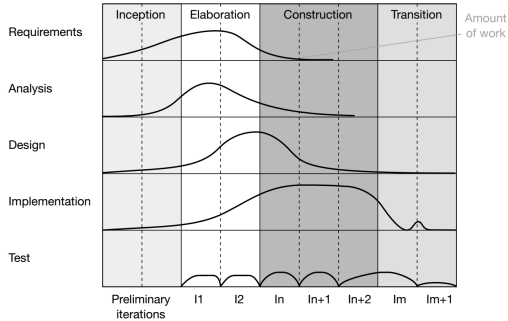


Figure: [1]

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- Establishing feasibility- This may concern proof of concepts and some technology decisions
- Business based study of the project.
- Capturing the essential functional requirements to build the system
- Identifying critical risks

The primary workers in this phase are the project manager and system architect

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Roughly speaking, the emphasis in this phase is on the requirements and analysis workflows. However, some design and implementation might also be done if it is decided to build a technical, or proof of concept, prototype.

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- Create an executable architectural baseline
- Refine the Risk Assessment
- Create a detailed plan for the construction phase
- Formulate a bid that includes resources, time, equipment, staff and cost

The main goal of Elaboration is to create an executable architectural baseline. This is a real, executable system that is built according to the specified architecture

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- **Requirements:** Refine system scope and requirements
- **Analysis:** Establish what to build
- **Design:** Create a stable architecture
- **Implementation:** Build the architectural baseline
- **Test:** Test the architectural baseline

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The goal of Construction is to complete all requirements, analysis and design, and to evolve the architectural baseline generated in Elaboration into the final system. A key issue in Construction is maintaining the integrity of the system architecture

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- **Requirements:** Uncover any requirements that had been missed
- **Analysis:** Finish the analysis model
- **Design:** Finish the design model
- **Implementation:** Build the Initial Operational Capability
- **Test:** Test the Initial Operational Capability

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The milestone is : the software system is finished ready for beta testing at the user site



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The Transition phase starts when beta testing is completed and the system is finally deployed.

- Correct defects
- Prepare the user site for the new software
- Modify the software if unforeseen problems arise
- Create user manuals and other documentation

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The emphasis is on the implementation and test workflows.

- **Requirements:** Not applicable
- **Analysis:** Not applicable
- **Design:** Modify the design if problems emerge in beta testing
- **Implementation:** Tailor the software for the user site and correct problems uncovered in beta testing
- **Test:** Beta testing and acceptance testing at the user site

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Agile, or Lightweight, Methodologies describe a set of principles for software development in way that they respond rapidly to any changes in requirements during the development process. The fact here, is to perform an agile process in way that it can evolve even with basic requirements. These methodologies enable the user to intervene many times during the development process.



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- Delivering working software frequently, from a couple of weeks to a couple of months

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- Delivering working software frequently, from a couple of weeks to a couple of months
- Different teams work together, may be in daily basis.



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- Delivering working software frequently, from a couple of weeks to a couple of months
- Different teams work together, may be in daily basis.
- Working directly with the customer

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- Different teams work together, may be in daily basis.
- Working directly with the customer
- Working on regular intervals

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- Welcome changing requirements, even late in development

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- Delivering working software frequently, from a couple of weeks to a couple of months
- Different teams work together, may be in daily basis.
- Working directly with the customer
- Working on regular intervals
- Welcome changing requirements, even late in development
- Working software is the primary measure of progress

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We are uncovering better ways of developing
software by doing it and helping others do it.
Through this work we have come to value:

Individuals and interactions over processes and tools
Working software over comprehensive documentation
Customer collaboration over contract negotiation
Responding to change over following a plan

That is, while there is value in the items on
the right, we value the items on the left more.

Figure: The Agile Manifesto [2]

Agile Methodologies History

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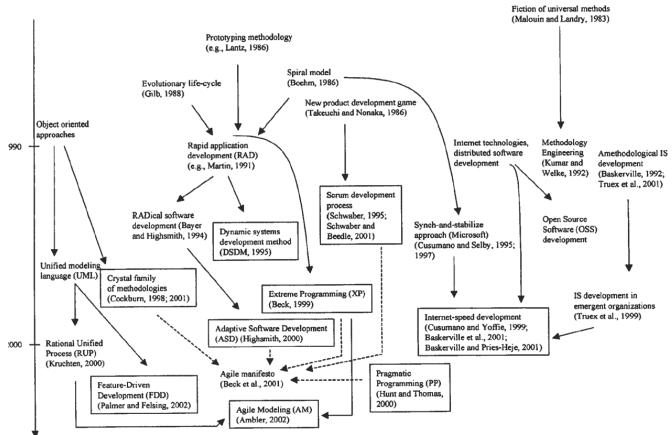


Figure: Agile History [2]

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- Extreme Programming
- Scrum
- Agile Unified Process
- Crystal Clear
- Dynamic systems development method (DSDM)

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XP (eXtreme Programming) was developed by Beck in 1996. It is intended to improve software quality and responsiveness to changing customer requirements.

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XP (eXtreme Programming) was developed by Beck in 1996. It is intended to improve software quality and responsiveness to changing customer requirements.

- Programming in pairs or doing extensive code review
- Continuous test, it starts even before writing code
- Avoiding programming of features until they are actually needed
- Expecting changes in the customer's requirements as time passes
- Simplicity and clarity in code

XP -Pair programming

Pair programming is an agile software development technique in which two programmers work together at one workstation. One, the driver, writes code while the other, the observer or navigator, reviews each line of code as it is typed in. The two programmers switch roles frequently.
[Wiki]



Figure: Pair Programming
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XP is an iterative and incremental process

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- XP is an Iterative methodology that allows the software to evolve in response to changes



XP is an iterative and incremental process

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- XP is an Iterative methodology that allows the software to evolve in response to changes
- XP applies incremental changes: for example, a system might have small releases every three weeks



XP Structure

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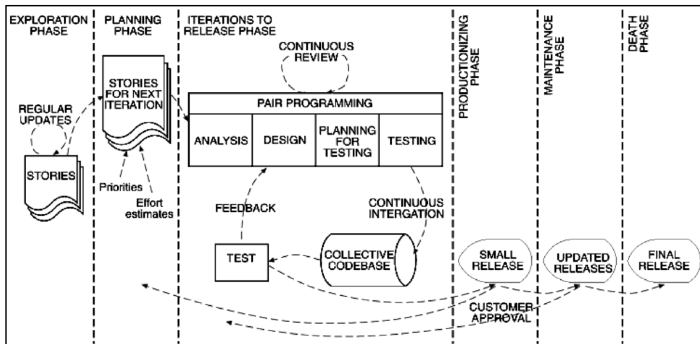


Figure: An overview of the XP process [2]

focuses on developing an initial list of high-level requirements, and determining the overall design of the system through prototyping.

Main steps

- **Formation of the development team:** The team will consist mainly of a coach acting as a coordinator, a number of programmers and business representative (customer), who should be always available during the development process activities.

focuses on developing an initial list of high-level requirements, and determining the overall design of the system through prototyping.

Main steps

- **Formation of the development team:** The team will consist mainly of a coach acting as a coordinator, a number of programmers and business representative (customer), who should be always available during the development process activities.
- **Creating User Stories:** Each user story represents a feature of the system as seen from the customer's point of view. In principle, they are very similar to use cases diagrams.

focuses on developing an initial list of high-level requirements, and determining the overall design of the system through prototyping.

Main steps

- **Formation of the development team:** The team will consist mainly of a coach acting as a coordinator, a number of programmers and business representative (customer), who should be always available during the development process activities.
- **Creating User Stories:** Each user story represents a feature of the system as seen from the customer's point of view. In principle, they are very similar to use cases diagrams.
- **Creating a Prototype:** It represents a high level description of how the system will work.

User story example

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#0001

USER LOGIN

Fibonacci Size # 3

As a **[registered user]**, I want to **[log in]**, so I can **[access subscriber content]**.

For new features, annotated wireframe. For bugs, steps to reproduce with screenshot. For non-functional stories, explain scope/standards.

User Login

Username:

Password:

Remember me ☐

[Forgot password?](#)

[message]

Store cookie if ticked and login successful.

User's email address. Validate format.

Authenticate against SRS using new web service.

Go to forgotten password page.

Display message here if not successful. (see confirmation scenarios over)

Further information is attached to this story on VSTS Product Backlog.

Typically, planning takes no more than a couple of days

Main steps

- **Estimation of development time:** Developers try to estimate the time required for developing user stories provided by the customer. Each user story should not take more than 3 weeks, short user stories might be merged into greater ones.
- **Prioritization of user stories:** The customer prioritizes the user stories according to their business value
- **Planning the first release:** The team selects a minimal, most valuable, set of user stories for implementation in the first release, and agrees on the release date. Even determining the iteration time is determined in this phase (between 1 to 3 weeks)

Its aim is to produce the first working release of the system as described by the release plan.

Main steps

- **Iteration planning:** a planning meeting is held during which the development team performs the following activities :
 - Selection of user stories to implement
 - Identification of programming tasks
 - Task sign-up and estimation

Its aim is to produce the first working release of the system as described by the release plan.

Main steps

- **Iteration planning:** a planning meeting is held during which the development team performs the following activities :
 - Selection of user stories to implement
 - Identification of programming tasks
 - Task sign-up and estimation
- **Development:** At each iteration, development is an iterative process itself, and consists of :
 - Holding daily stand up meetings
 - Analysis, design, coding, testing, and integration in a Collective-Code Ownership environment

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Main steps

- **System-wide verification and validation:** At this phase, the release is subjected to different tests to ensure user's approval
- **Deployment into the production environment:** The release is introduced into the user environment

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- This post-deployment phase of the XP process follows the same phases and encompasses the same activities as those in the previous three phases. Just, developing the new changes in requirements will be adapted to an already running and operational system
- The maintenance phase continues until either there are no more user stories to develop and none are anticipated in the future



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The project is declared dead when evolution is either unnecessary or impossible

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- Developer
- Client
- Tester
- Tracker
- Manager
- Coach

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- Is responsible for both conception and programming
- Participate in all meetings during planning
- Defining unit tests



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- Provides requirements and explain scenarios
- Defines the priorities
- Defining unit tests



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- Writing acceptance tests to be validated by the customer
- He could affect the choice of scenarios by the customer

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- He helps with defining requirements
- Acts as a liaison between customer and developers to refine and transforms customer's needs into functionalities.



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- Ensures the satisfaction of client's needs
- Coordinating and handling external communications
- Resource management

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- Organizes and leads planning meetings
- He provides the workspace in which team members can give their best.
- He helps the team to integrate in the working environment, and inform the team by any change.

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- Both methodologies are iterative and incremental
- XP's User Stories are equivalent to UP Use Cases
- UP comparing to XP is a heavy process with a lot of options
- XP is appropriate for small teams (not more than 12 developers)
- UP is a good choice for large projects that require much documentation

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- 1 Jim Arlow and Ila Neustadt, *UML and the Unified Process Practical Object-Oriented Analysis and Design*, Pearson Education Limited 2002
- 2 RAMAN RAMSIN and RICHARD F. PAIGE, *Process-Centered Review of Object Oriented Software Development Methodologies* , ACM Computing Surveys, Vol. 40, No. 1, Article 3, Publication date: February 2008