

# Course: Software Technologies and Enterprise Architecture



## **WEEK 5: Software Development Methodologies**

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# Week-5: Software Development Methodologies

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2. Importance of Methodologies in Software Development
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# Week-5: Software Development Methodologies

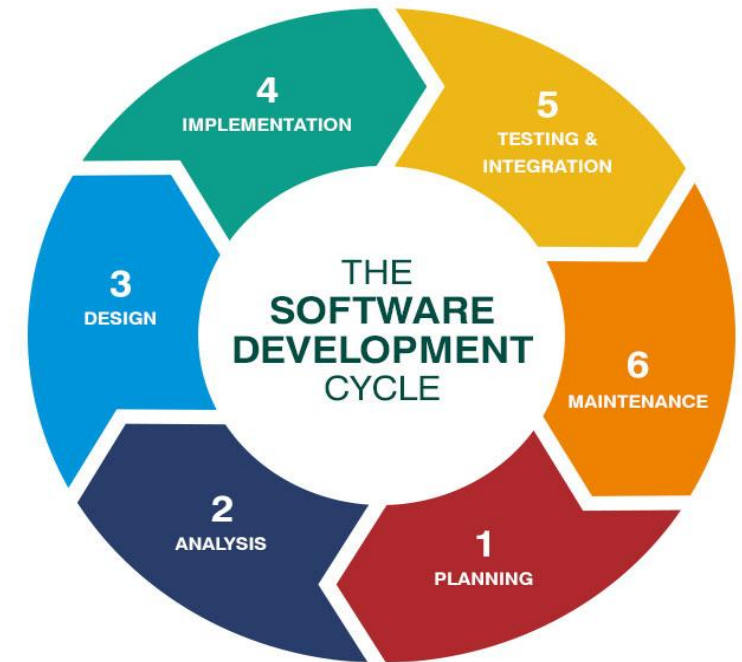


**By the end of this lecture, the student will be able to**

- Define Software Development Life Cycle (SDLC) and its purpose
- Explain what a software development methodology is and its role in system development
- Describe the importance of methodologies in ensuring quality, structure, and efficiency
- Identify and compare different software development models (e.g., Agile, Waterfall, Scrum, Spiral, etc.)
- Analyze the advantages and disadvantages of major development methodologies.
- Select appropriate methodologies based on project requirements, size, and complexity

# 1. Introduction to Software Development Methodologies

- The Software Development Life Cycle (SDLC) is a structured process used to plan, design, develop, test, deploy, and maintain software.
- It ensures a systematic workflow and helps align software development with business goals and user requirements.
  - Provides a clear and organized framework for managing development phases
  - Helps in early detection of defects, reducing overall cost and time
  - Ensures high-quality software delivery that meets user expectations



# Cont. ...1. Introduction to Software Development Methodologies

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- Software Development models are a structured framework used to plan, manage, and execute the creation of information systems.
- It provides a roadmap for every stage of development—conceptualization, requirement gathering, design, coding, testing, deployment, and maintenance.
- Beyond technical aspects, these methodologies emphasise collaboration among developers, testers, project managers, and end-users to ensure the final product resonates with business objectives and user needs.

[2]. What is Software Development Methodology? The Knowledge Academy, The Knowledge Academy, 04 March 202. <https://www.theknowledgeacademy.com/blog/what-is-software-development-methodology>.

# Cont. ...1. Introduction to Software Development Methodologies

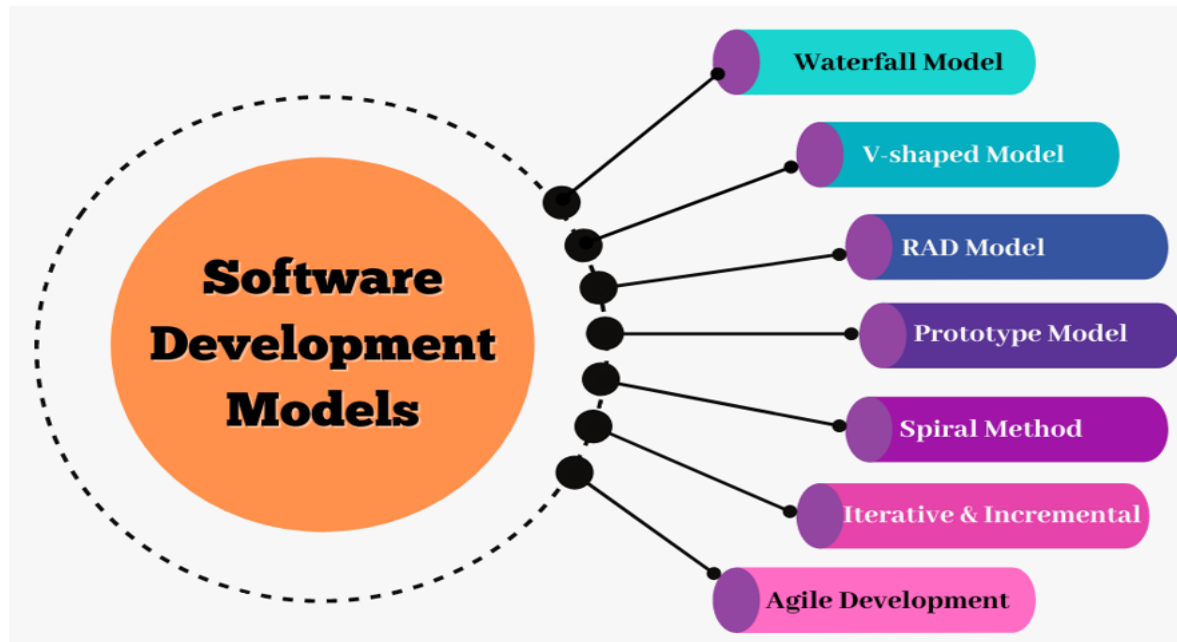
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- Software Development models introduce step-by-step procedures to ensure each phase is thoroughly addressed, enhancing software robustness, usability, and compliance with requirements.
- There is no single approach among these Methodologies; the choice depends on project complexity, timelines, and goals.
- Evolving with industry trends, these frameworks help identify risks early, promote consistency, and drive continuous improvement across projects.

[2]. What is Software Development Methodology? The Knowledge Academy, The Knowledge Academy, 04 March 202. <https://www.theknowledgeacademy.com/blog/what-is-software-development-methodology>.

# Cont. ...1. Introduction to Software Development Methodologies

- Each methodology has been shaped by different underlying philosophies and objectives, making them suitable for various project needs



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# 2. Importance of Methodologies in Software Development

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- Software Development Methodologies play a pivotal role in shaping the course of creating digital solutions.
- Its importance is multi-faceted and deeply entrenched in the success of software projects.

## Here's why Software Development methodologies are crucial.

**a) Structural Framework:** Methodologies provide a structural framework, ensuring that every stage of the Software Development process is meticulously planned and executed.

**b) Risk Management:** Software projects, irrespective of their scale, are troubled with risks from evolving requirements and technological challenges to team dynamics.

# Cont. .2. Importance of Methodologies in Software Development

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**c) Quality Assurance:** Methodologies lay down processes, standards, and best practices that ensure the software meets the desired quality benchmarks in terms of functionality, performance, security, or user experience.

**d) Efficient Resource Utilisation:** Methodologies guide the optimal allocation and utilisation of these resources.

- They ensure that projects are finished within budget and timelines without compromising on quality.

# Cont. .2. Importance of Methodologies in Software Development

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**e) Stakeholder Communication and Collaboration:** Regular check-ins, feedback loops, and reviews ensure that everyone, from developers and testers to clients and end-users, stays aligned with the project's objectives and progress.

**f) Adaptability:** Today, users' needs and market dynamics are constantly evolving; thus, being adaptable is key. Agile Methodologies, for instance, allow teams to pivot based on feedback, ensuring the end product remains relevant and valuable.

# 3.Types of Software Development Models

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## 1. Agile Methodology

- Agile methodology is one of the most popular software engineering techniques in which various software production methodologies are related to the principles of Agile.
- The main objective of Agile methodologies is to finish the product with collaborative efforts, and the main benefit of this methodology is that it ensures regular release of products and continuous improvement with every iteration.

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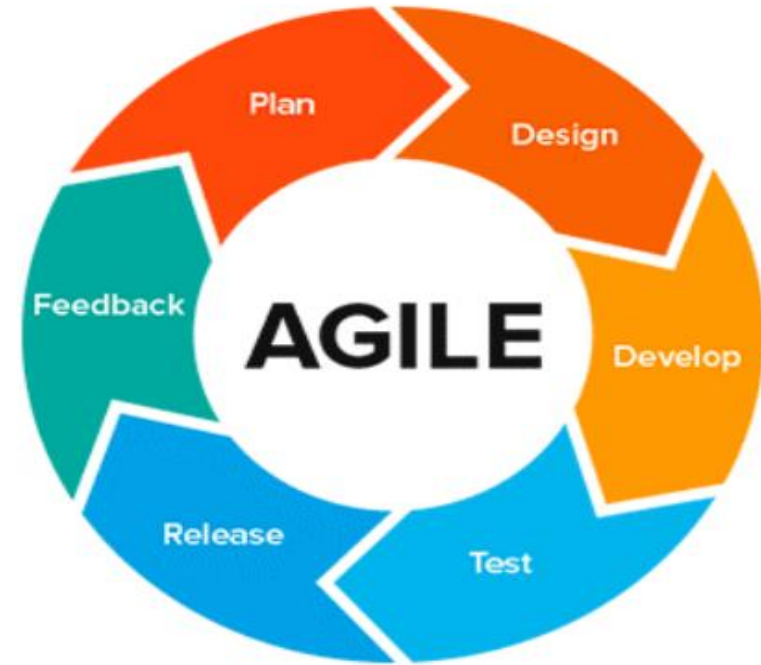
## Advantages of Agile Methodology

- Due to the involvement of small iterations, it delivers a high quality of output.
- With the help of Agile methodology allows creative improvements whenever working on the software product.
- The agile methodology is popular for its minimal dependance and adaptivity on the initial documentation.

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## Disadvantages of Agile Methodology

- Agile methodology doesn't consist of any deadlines.
- Agile methodology also lacks clarity and a project vision.



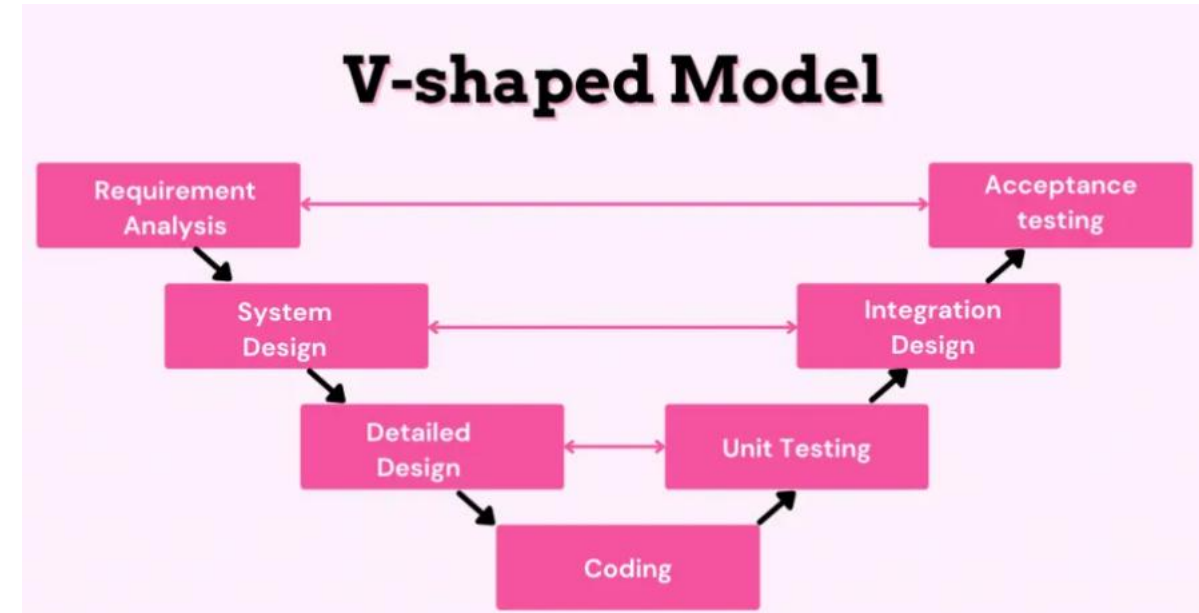
*Agile Software Development Methodology*

[3]. What is Software Development Methodology? 15 Key Methodologies, GeeksforGeeks, GeeksforGeeks, 2023. <https://www.geeksforgeeks.org/software-engineering/what-is-software-development-methodology-15-key-methodologies/>

# Cont.' .....3. Types of Software Development Models

## 2. The V model

- It is named the Verification and Validation model as it's an extension of the waterfall model.
- One can gather the needs at the beginning, as later it cannot be changed.
- One needs to have a corresponding testing activity for each stage.



[4]. Top 7 Software Development Models Overview, Haniska Roy, Medium, 2021. <https://hanisk-roy.medium.com/top-7-software-development-models-overview-daa3bc9d5717>

# Cont.' .....3. Types of Software Development Models

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## .... V model

- The Model is easy to understand, highly disciplined, and makes it easier for project management.
- It isn't suitable for a complex project as there might be changing needs and unclear concepts.
- But the V model is the right choice for all software development for all downtimes and failed projects.

[4]. Top 7 Software Development Models Overview, Haniska Roy, Medium, 2021.  
<https://hanisk-roy.medium.com/top-7-software-development-models-overview-daa3bc9d5717>

# Cont.' ....3. Types of Software Development Models

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## 3. Lean Development

- The Lean development methodology focuses on developing *cost-effective* and *high-quality software*.
- The lean development workflow particularly follows a *minimalist approach* for deleting the extra elements, such as documentation and meetings.
- The main objective of lean development is to make software that can easily accommodate changes.

[3]. What is Software Development Methodology? 15 Key Methodologies, GeeksforGeeks, GeeksforGeeks, 2023. <https://www.geeksforgeeks.org/software-engineering/what-is-software-development-methodology-15-key-methodologies/>

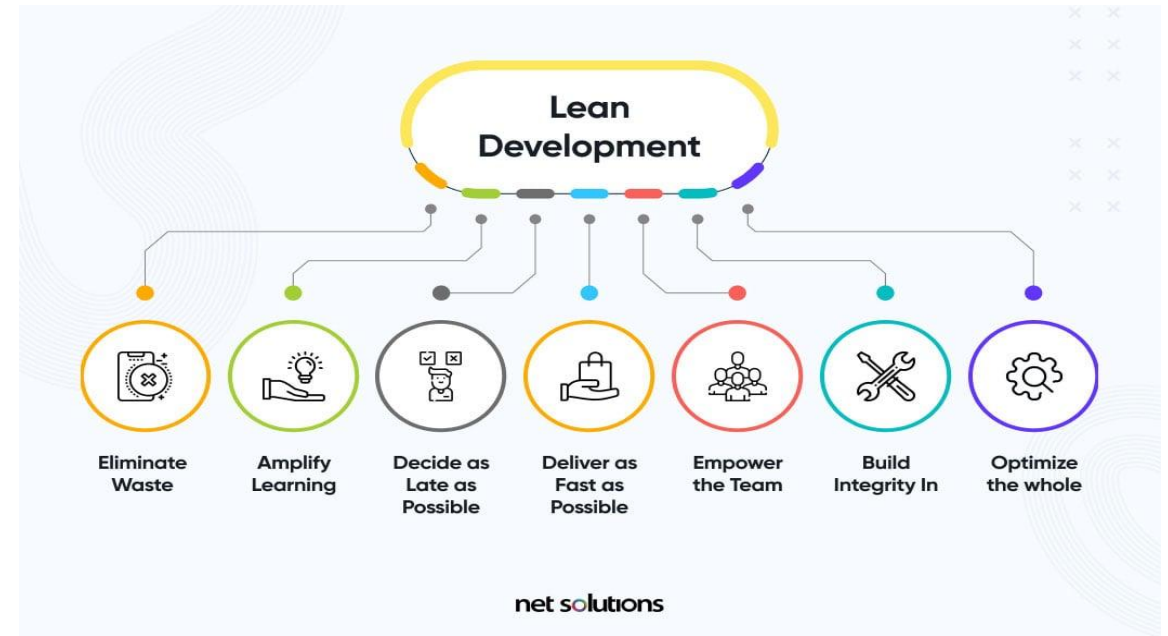
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## Advantages of Lean Development

- Lean methodology is effective as it is cost-friendly.
- The lean development allows the team to speed up the software development process and to finish more projects in a short period of time.

## Disadvantages of Lean Development

- Lean development lacks documentation concerning business means.



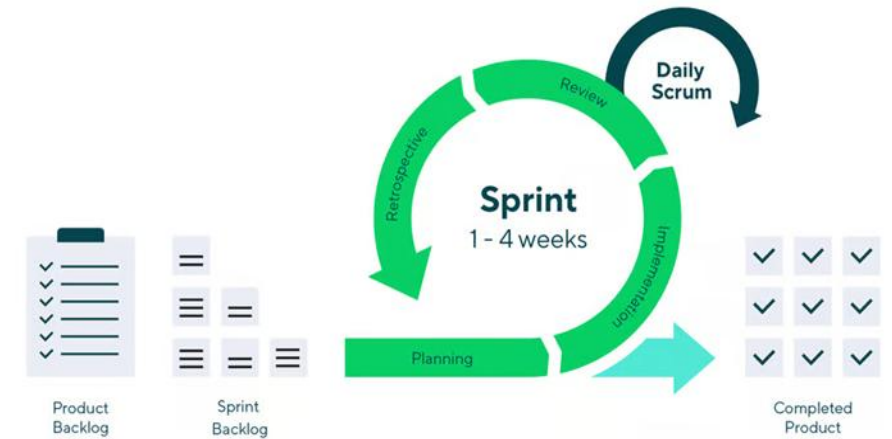
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# Cont.' .....3. Types of Software Development Models

## 4. Scrum Methodology

- Scrum is one of the most popular frameworks that is based on the agile methodology, which is empirical in nature, and it is famous for managing projects that *do not* have well-defined feedback from the customers.
- Scrum is a loop. We plan, build, check, and adapt, repeating this process until the product delivers the value users need.
- This cycle of focus and flexibility makes Scrum very effective for complex projects.



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[3]. What is Software Development Methodology? 15 Key Methodologies, GeeksforGeeks, GeeksforGeeks, 2023. <https://www.geeksforgeeks.org/software-engineering/what-is-software-development-methodology-15-key-methodologies/>

# Cont.' .....3. Types of Software Development Models

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## **Advantages of Scrum Methodology**

- Scrum methodology helps the team members make decisions on the main principal project.
- With the help of the scrum methodology, the developers can detect the problems quickly and easily.

## **Disadvantages of Scrum Methodology**

- Scrum is not effective for junior team members, and it is also less effective for the big project types.

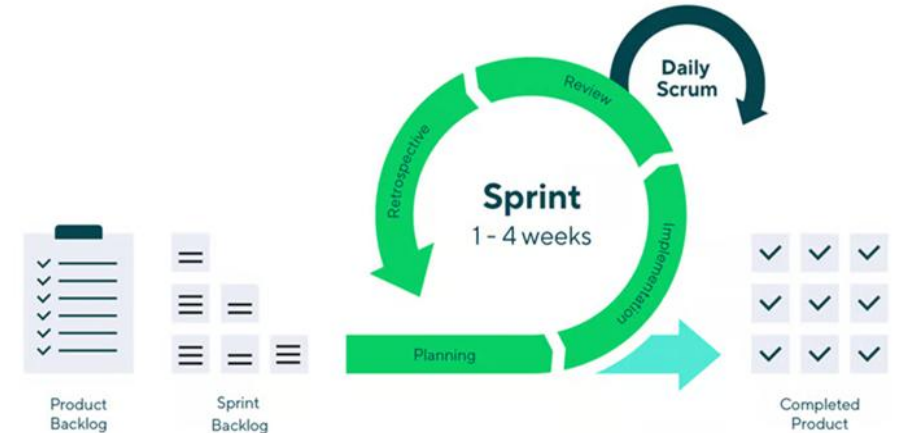
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# Cont.' .....3. Types of Software Development Models

## How does Scrum methodology work?

### The Scrum cycle follows five steps:

- **Shape the product backlog:** Everything starts with a living to-do list of features, fixes, and ideas.
  - It's prioritized so the team always knows what delivers the most value next.
- **Plan the sprint:** At the start of each sprint, the team selects the most important items and defines a clear sprint goal.
  - This turns strategy into an actionable plan for the next two to four weeks.



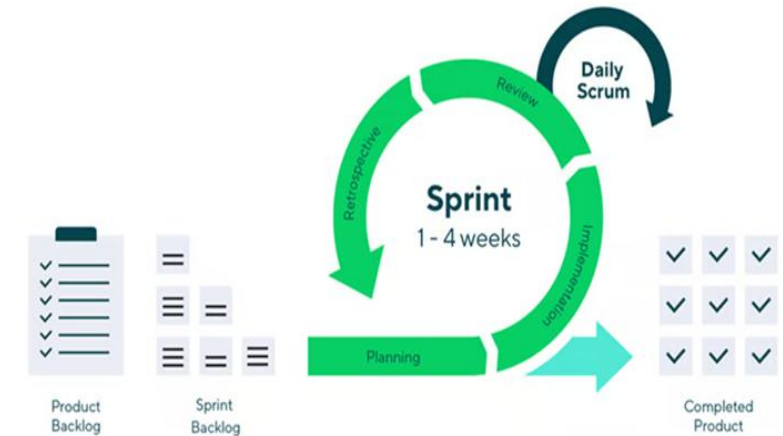
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## .....How does Scrum methodology work?

### The Scrum cycle follows five steps:

- **Run the sprint:** The team gets to work, collaborating daily and tackling obstacles as they arise.
  - Daily standups keep everyone aligned and make blockers visible before they slow things down.
- **Review the work:** At the end of the sprint, the team demonstrates what they've built — not as a final product, but as an increment that stakeholders can see, test, and give feedback on.
- **Reflect and improve:** Finally, the team holds a retrospective to look at how they worked together, what slowed them down, and how to get better in the next cycle.
  - Small tweaks add up to big gains over time.



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## 5. Waterfall Methodology

- Waterfall methodology is one of the traditional methods which consist of a popular classic approach, and it is also a popular version of the software development lifecycle in the field of software engineering.

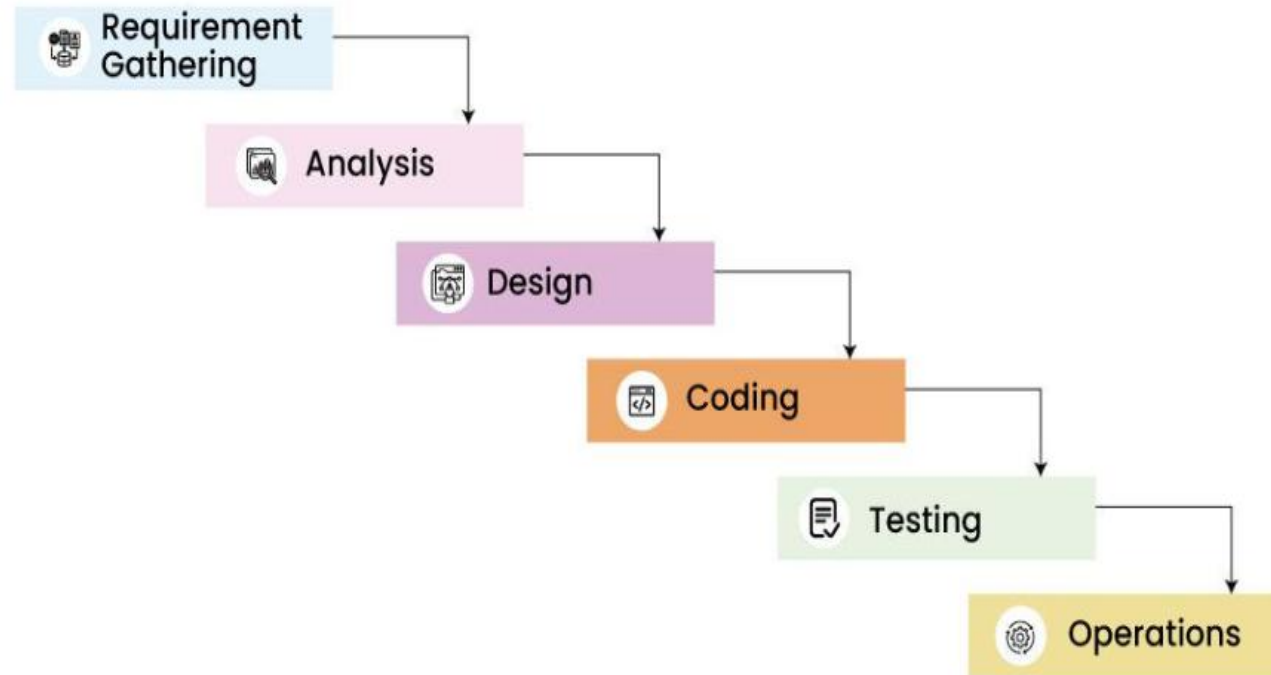
### Advantages of the Waterfall Methodology

- Waterfall methodology can easily manage small projects and has a separate review process.
- The waterfall methodology consists of separate development stages with deadlines.

# Cont.' ....3. Types of Software Development Models

## Disadvantages of Waterfall Methodology

- Waterfall methodology is not applied to projects that need modifications along the way.



# Cont.' ...3. Types of Software Development Models

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## 6. Feature Driven Development (FDD)

- FDD refers to Feature Driven iterative methodology, but it is in combination with object modelling, and it is also beneficial for big team projects.
- FDD is a five-step development process that helps in accelerating the software delivery easily.

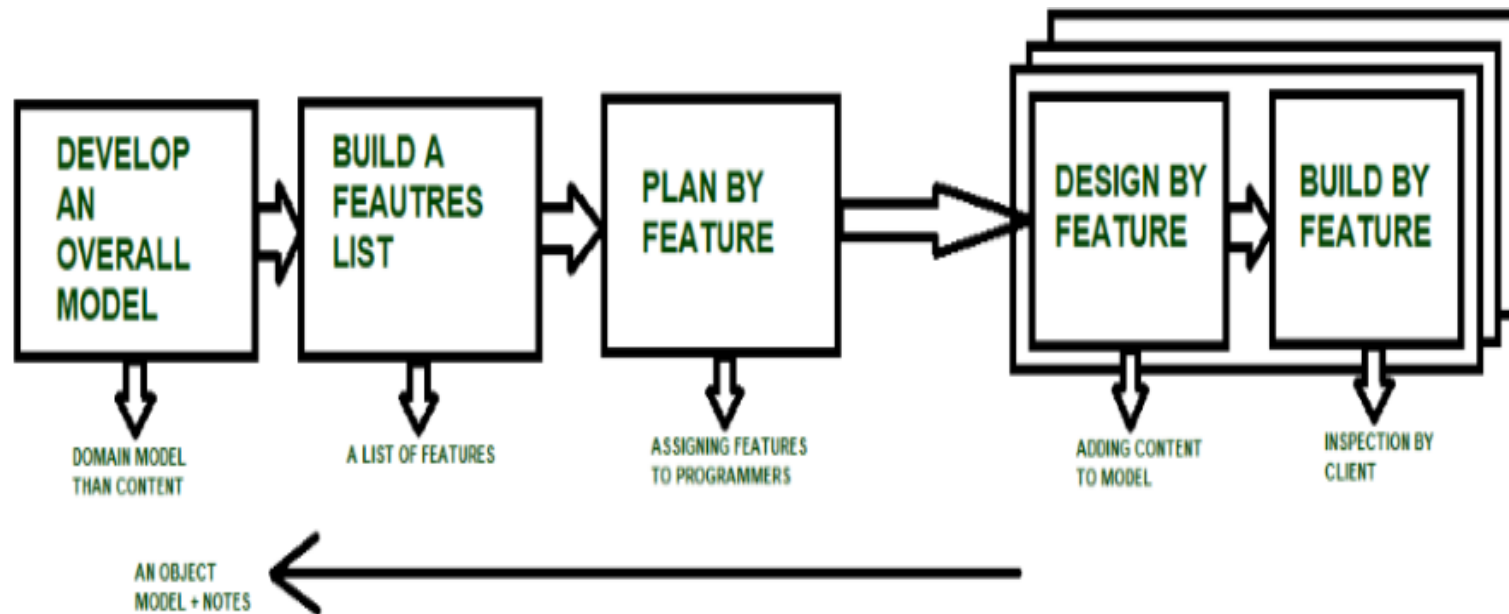
### Advantages of Feature Driven Development (FDD)

- Feature Driven Development supports various teams that work in parallel.
- FDD covers up all the big or small projects that require some sequential updates.
- This feature-driven development methodology is mainly suitable for large projects.

# Cont.' .... 3.Types of Software Development Models

## Disadvantage of Feature Driven Development (FDD)

- FDD provides no documentation support to the project owners.
- FDD is a complex pattern development for the junior developers.



*Feature Driven Development (FDD)*

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## 7. Spiral Methodology

- The Spiral Model, pioneered by Professor Barry Boehm in 1986, is a software development approach that combines elements of both waterfall and iterative methodologies.
- This risk-driven process model guides teams through repeated cycles of development, each building upon previous iterations.
- As development teams complete each loop, they gain deeper insights into the project's requirements, potential risks, and optimal solutions.
- This progressive understanding allows teams to refine their approach and deliver more sophisticated versions of the software with each iteration.

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## Key Characteristics of the Spiral Model:

- **Risk-Driven Approach:** The Spiral Model places risk assessment at its core, making it particularly suitable for large, complex projects.
- **Continuous Refinement:** Teams gather feedback and insights after each iteration, enabling continuous improvement.
- **Flexible Planning:** The model adapts to changing requirements and new understanding gained throughout the development process.

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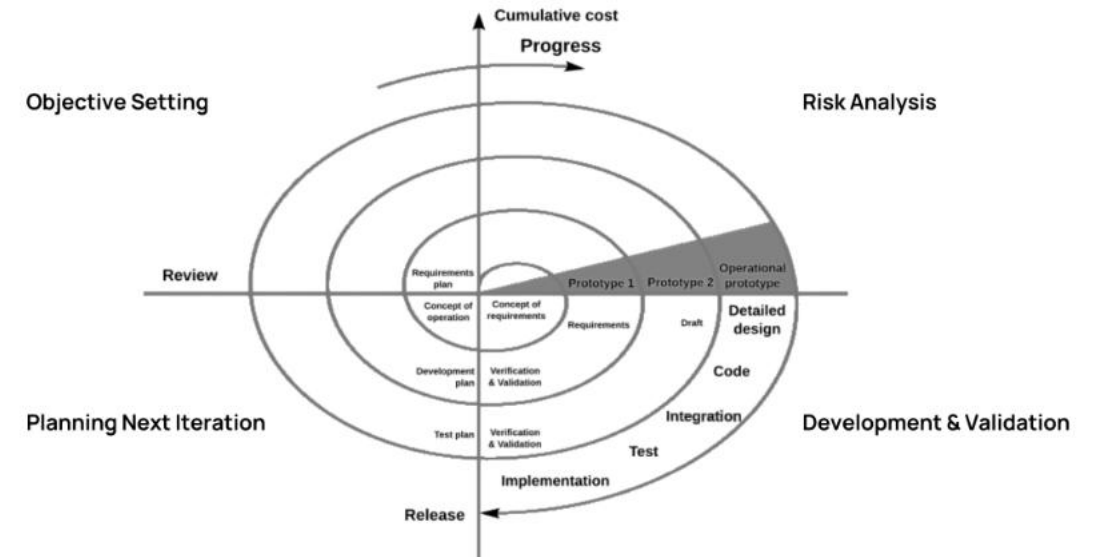
## Advantage of Spiral Methodology

- Spiral methodology involves large risk analysis which further leads to less risks.
- The main advantage of the spiral model is that required changes can be made even in the last testing stage.

## Disadvantage of Spiral Methodology

- Spiral methodology is a complete waste of resources for the projects which consists of low risks factors.

## Spiral Model in Software Engineering



[3]. What is Software Development Methodology? 15 Key Methodologies, GeeksforGeeks, GeeksforGeeks, 2023. <https://www.geeksforgeeks.org/software-engineering/what-is-software-development-methodology-15-key-methodologies/>

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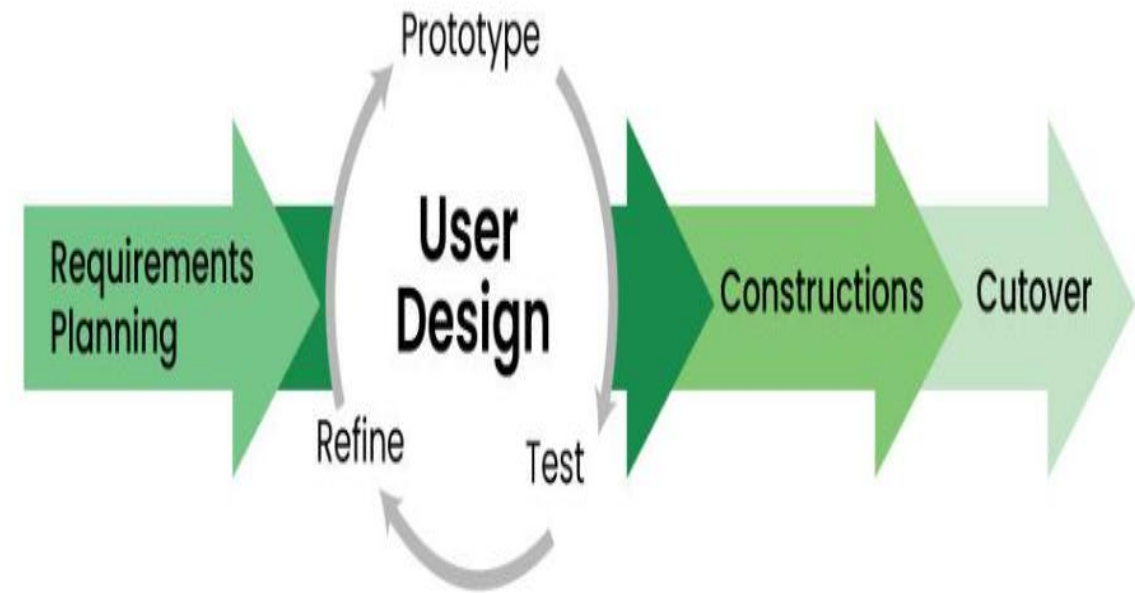
## 8. Rapid Application Development (RAD)

- RAD is made of delivering speedy results with high-quality software, and this method is particularly complemented by the participation of active users in the process of development.
- Prioritizes development and building a prototype rather than planning.
- Developers can quickly make multiple iterations and updates to the software without starting from scratch.
- This helps ensure that the final outcome is more quality-focused and aligns with the end users' requirements.

# Cont.' ....3. Types of Software Development Models

## Advantages of Rapid Application Development (RAD)

- The RAD model is a regular testing method which deletes the chances of drastic errors.
- RAD models tasks are completed separately and then integrated into one project.



## Disadvantages of Rapid Application Development (RAD)

- RAD is not applicable and practical for low-budget projects.

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## 9. Prototyping Methodology

- Prototyping methodology is a type of model where software developers initially make a prototype of the software solution and also visualize how it can run and prove its functions to the customers.

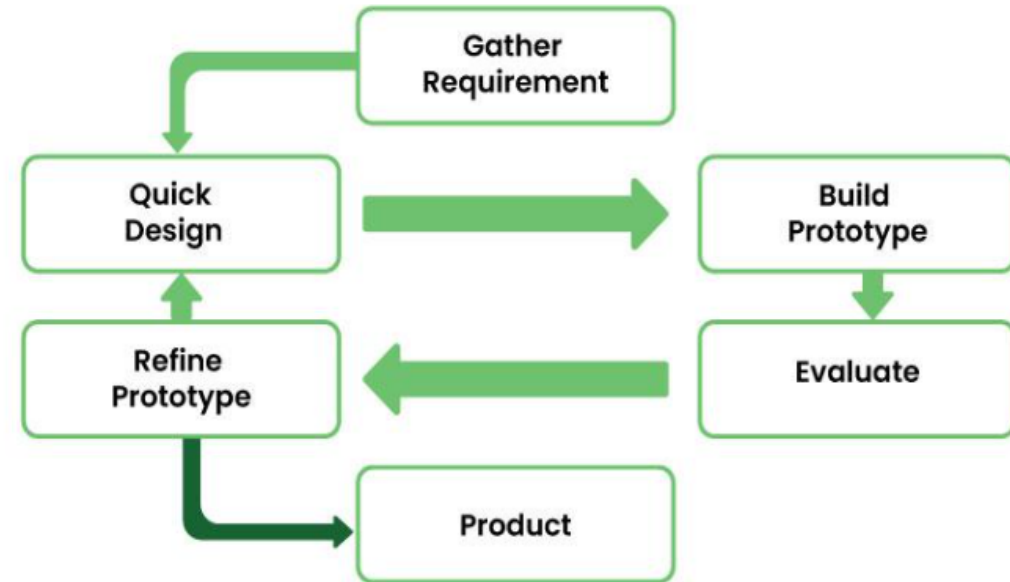
### Advantage of Prototyping Methodology

- Prototyping methodology is used by the software developers who are working on a prototype and can easily scale it with the anticipation of the customer.
- Prototyping is the best way to present the software project in front of the customers or the clients.

# Cont.' .....3. Types of Software Development Models

## Disadvantage of Prototyping Methodology

- In prototyping methodology, regular changes in the design can slow down the workflows.



[3]. What is Software Development Methodology? 15 Key Methodologies, GeeksforGeeks, GeeksforGeeks, 2023. <https://www.geeksforgeeks.org/software-engineering/what-is-software-development-methodology-15-key-methodologies/>

# Cont.' .....3.Types of Software Development Models

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## 10. Adaptive Software Development

- The adaptive software development model is a non-linear approach that helps to meet the initial objective and goals by adapting the requirements of the business.
- ASD assumes that every life cycle can be iterated and modified whenever another one is executed.

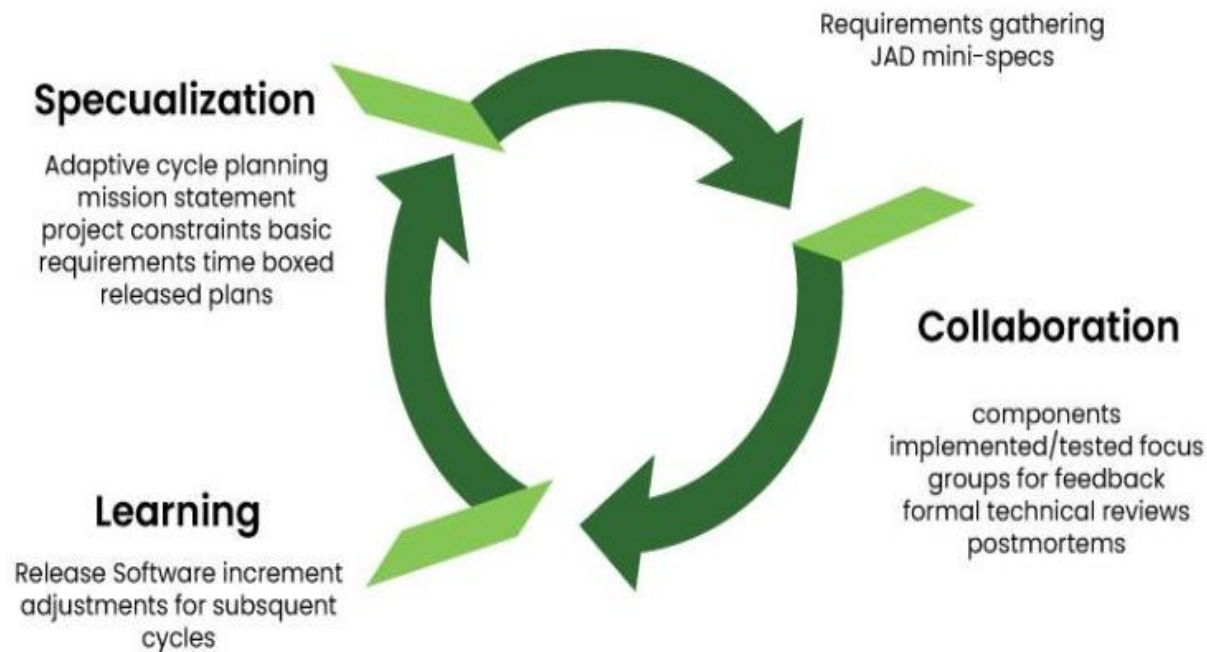
### Advantages of Adaptive Software Development

- ASD method tools make sure that the development occurs in high-quality and low-maintenance products.
- For quickly changing the requirements, short feedback loops provide more opportunities.

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## Disadvantage of Adaptive Software Development

- ASD involves regular collaboration with the users throughout the development phase which takes a lot of time.



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## 11. Dynamic Systems Development Model

- It is an easy-to-use methodology, and its main principle is the model is a perfect software that involves *end users a lot* and establishes a basic understanding of system functions.

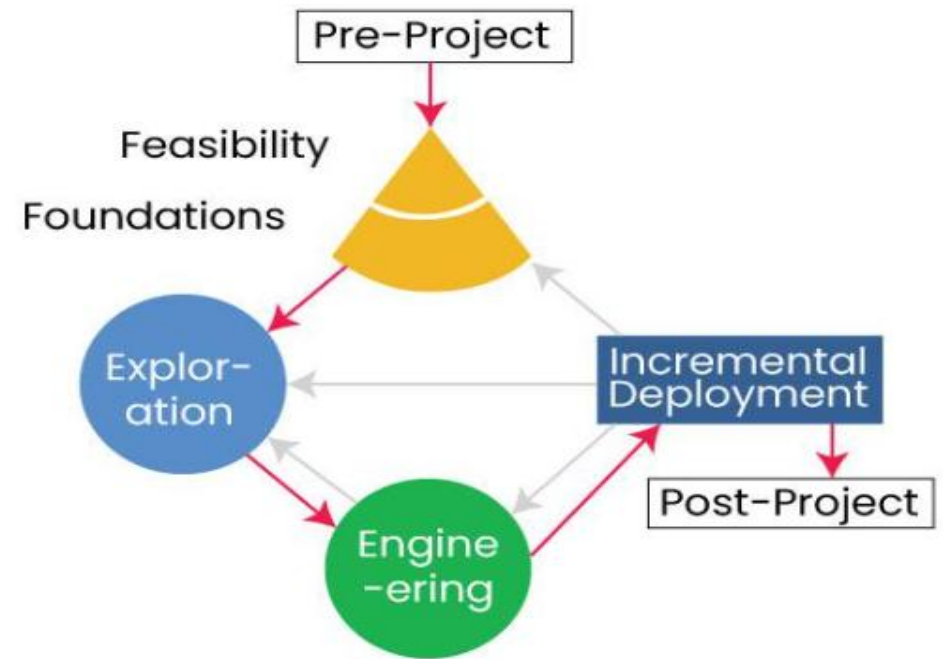
### Advantages of Dynamic Systems Development Model

- Dynamic system models are always in the budget range and timeframe.
- This dynamic system development model is easy to use with the access of end users by the software developers.

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## Disadvantage of Dynamic Systems Development Model

- Dynamic systems models are only useful for businesses with one time projects or low budgets.



[3]. What is Software Development Methodology? 15 Key Methodologies, GeeksforGeeks, GeeksforGeeks, 2023. <https://www.geeksforgeeks.org/software-engineering/what-is-software-development-methodology-15-key-methodologies/>

# Cont.' .....3.Types of Software Development Models

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## 12. DevOps Methodology

- DevOps methodology is used in IT operations to function together and allows the teams to collaborate from the design phase to the product release phase.
- DevOps also provides developing, testing, and releasing software on short time.

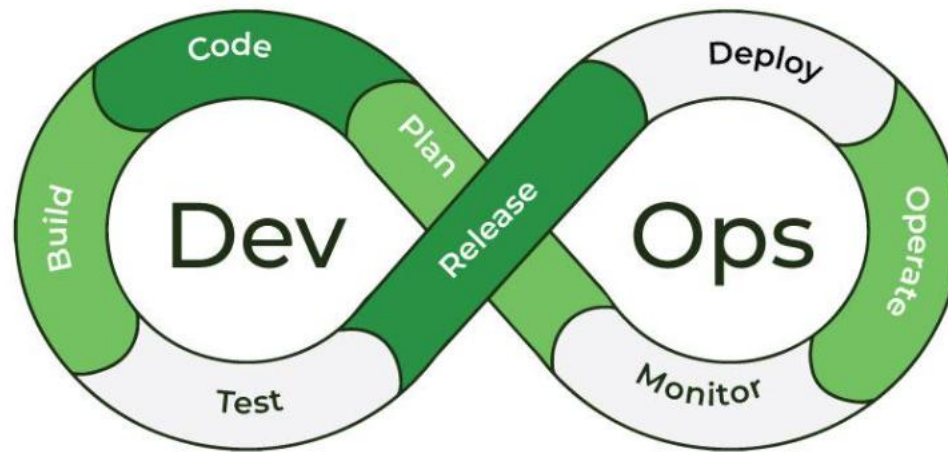
### Advantages of DevOps Methodology

- DevOps methodology provides regular delivery and also allows the company to make product improvements whenever it is needed.
- The simultaneous delivery of work between both teams on the project activities accelerates the software delivery.

# Cont.' ....3.Types of Software Development Models

## Disadvantage of DevOps Methodology

- DevOps production environment in the cloud results in compatibility issues.



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## **13. Joint Application Development Methodology**

- Joint Application Development methodology is used for the business software solutions, and the design and development stages of software production are involved in interactive workshops.

### **Advantages of Joint Application Development Methodology**

- In joint application development, high-quality software is developed with a low tendency for errors.
- Joint application methodology develops insights through the exchange of valuable information between the developers and users.

# Cont.' ....3. Types of Software Development Models

## Disadvantage of Joint Application Development Methodology

- The joint application methodology is a time consuming method for any project development team.



[3]. What is Software Development Methodology? 15 Key Methodologies, GeeksforGeeks, GeeksforGeeks, 2023. <https://www.geeksforgeeks.org/software-engineering/what-is-software-development-methodology-15-key-methodologies/>

# Summary

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- Software products are primarily classified into two main categories: Generic and Customized.
- Software development methodologies play a crucial role in the software development process.
- They benefit organizations in numerous ways by assisting developers in producing high-quality and cost-effective software products.
- Methodologies improve software quality through standards, testing, and best practices. They support efficient use of resources such as time, cost, and workforce.
- Communication and collaboration among stakeholders are enhanced through defined processes.
- This chapter discusses the most prominent software development methodologies, providing a detailed understanding of each one along with its respective benefits.
- **Agile** – flexible, iterative, continuous improvement, **Waterfall** – linear and structured, best for stable requirements, **Scrum** – Agile-based, teamwork, and fast feedback
- **V-Model** – testing integrated at every stage, **Spiral** – risk-driven, suitable for complex projects, **RAD** – fast development with user involvement
- **Prototyping** – early model to visualize the system, **Lean** – focuses on cost reduction and efficiency, **DevOps** – integrates development and operations

# Cont.' ..Summary

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## **Key Takeaways of the Week's lesson**

- No single methodology fits all projects
- Choice depends on project size, complexity, and requirements
- Methodologies improve the quality, efficiency, and success rate of software projects
- Agile is best for dynamic environments, while Waterfall suits stable projects
- Combining models (e.g., Spiral) can handle complex and high-risk systems

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