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ADVANTAGES AND DISADVANTAGES OF THE WATERFALL MODEL
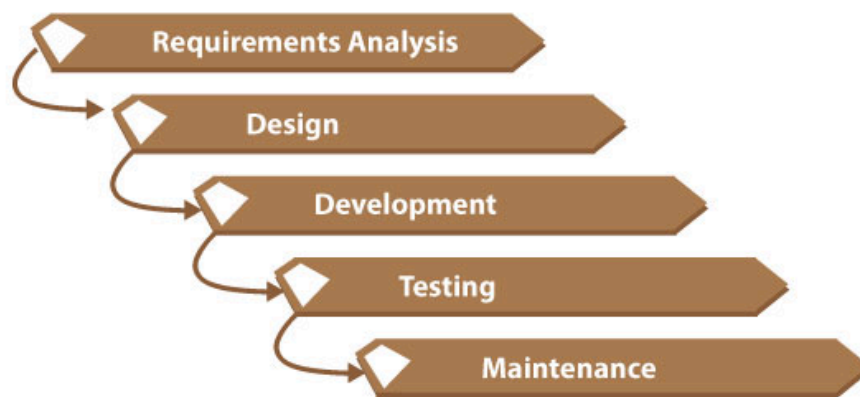
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Technology has evolved so quickly and has transformed the world in its own manner. Manual methods for most of the tasks have been replaced by automated methods and all of this is due to the emergence of software development. To develop any kind of computer software and information systems, different methodologies have been used by the developers which are basically a framework used to plan, control, and manage the process of development of an information system. All these methodologies lie under the concept of Sequential Development Life Cycle SDLC.

SDLC-SEQUENTIAL DEVELOPMENT LIFE CYCLE

Software Development follows SDLC methods for the development of a new project. The SDLC is a process having several important stages. These stages perform different functions and do not affect each other's performance.

The result of one stage serves as the key to the next phase.
SDLC helps the development team able to plan, design, produce and deliver high-quality software.
The SDLC approach improves the quality of the software and the overall development process.

The general phases of the Sequential Developmental Life Cycle are:

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Requirement Analysis

Design

Implementation

Testing

Deployment and Maintenance

All the above-mentioned phases are applicable to any **Software Development Methodology**. But the activities and duration are limited for each model e.g. Waterfall Model or Agile.

From the initial to final stage, software application development uses SDLC methods for the processing and delivering of the project.

Given below are some common SDLC models:

Waterfall Model

V Model

Iterative Model

Spiral Model

Agile Model

WHAT IS THE WATERFALL MODEL?

Software industry used the Waterfall model as the first approach to software development. Winston Royce introduced this model back in 1970.

This is a traditional method in software development.

Waterfall model is a "linear-sequential life-cycle model.

The word waterfall indicates that this model is linear and flow like a waterfall from high to low level. It has five to seven stages which have different tasks to perform.

Whereby, all the stages collectively describe the whole life cycle.

The model runs sequence-wise, in which one stage follows the next stage and the cycle continues.

There is no overlapping or turning back of the phases. The output of each phase functions as the input of the next phase.

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Small software development projects use the waterfall model.

These projects are easy to handle and do not have unclear requirements.

PHASES OF THE WATERFALL MODEL:

To understand the Waterfall model thoroughly, one must have to know the details of its

phases.

All the phases work precisely and are independent of each other.

The seven successive phases of the Waterfall model are:

System Requirements

Software Requirements

Requirements Analysis

Program Design

Implementation or Deployment

Testing

Launch

SYSTEM REQUIREMENTS:

It is the very first phase of the Waterfall model which deals with the requirements of business-

related features such as price and availability. Other pieces such as safety and

documentation are also specified to this phase.

Business analysts collect and evaluate all the business-related requirements.

Generally, this stage focuses on non-functional requirements.

System requirement stage does not deal with digital requirements.

SOFTWARE REQUIREMENTS:

The second phase deals with the functional requirements of the software. The output of the

first phase helps to define the specifications of the software. The requirements of the

software are enhanced which tells about the competence of the software.

REQUIREMENT ANALYSIS:

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Requirement analysis phase separates and configures individual functional elements. Functional units also split from each other. This phase examines the software functions to check its feasibility and importance.

Specifications containing the requirements that need to be developed comes as the output of this phase

PROGRAM DESIGN:

The requirement specifications collected in the previous two steps help to apply the technical design. The program design phase has several components including information architecture and applied technologies. For example, programming language, programming sequences, and class libraries etc. Thus, the program design stage plans the programming language e.g. Java, PHP, .net. It also plans the database such as Oracle, MySQL etc. Furthermore, it plans high-level technical details of the project. This stage diagrammatically records the output which describes the theoretical behavior of the software.

IMPLEMENTATION:

This stage takes systematic framework conditions and objectives into account and implements the workflows and structures.

The software design develops into a program which is directly related to one or more programming language, operating system, and the foundation. The result is often a beta-version of operational software.

TESTING:

This phase tests all software components, units, and the entire system. It also tests the combination of software into a specific operating system. If any error or hindrance occurs, then they must be repaired immediately. The situation in which the error arises can lead to an increased overall cost since possible errors can occur at any point of different phases.

LAUNCH:

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The software implements once the client accepts it. Software update and maintenance are necessary before the launch of the software.

A team of various experts including project management, contractors, developers works together on all the phases.

Implementation phase involves the work of project managers and contractors. After implementation, developers do most of the work. Independent tests labs examine the software. Once the lab testing verifies the software, marketing and service experts launch the software.

EXAMPLES OF WATERFALL MODEL:

The Waterfall model helps in the development of business applications.

These include Customer Relationship Management System, Supply Chain Management Systems etc. Similarly, it also includes Human Resource Management Systems, Point of Sales System, and Inventory Management Systems.

APPLICATION OF WATERFALL MODEL:

The Waterfall method is suitable for the following software development projects:

    For the development of an E-commerce portal or website

    Development of network protocol software

    To develop database related software

Waterfall model is helpful and appropriate for situations such as projects having the following criteria:

    Requirements of the project are fixed, and clear.

    Documentation is clear

    The definition of the product is stable.

    Technology is not dynamic and well understood.

    No hazy requirements.

    Enough resources are available with the required expertise to support the product.

    The key should require the development side instead of the financial

    The project is a short

WHERE TO APPLY THE WATERFALL MODEL?

Waterfall model is appreciable for the development of projects where the requirements are clear. For example, a project with known, fixed, and clear requirements are suitable for the application of the Waterfall model. Migration projects use this kind of SDLC model where the requirements e.g. language remains the same.

In the field of software engineering, the Waterfall model is the best approach to software development.
Though it has some limitations but has proved to be finest for small projects having clear specifications.

ADVANTAGES AND DISADVANTAGES OF THE WATERFALL MODEL:

Waterfall development methodology is ideal for the projects in which making initial changes can be very costly.
Many global industries have projects in which changes in the mass market are not critical. The main issue with the Waterfall model is that revisions are not necessarily provided by logical sequences. The feedback from engineers, testers, and customers during the development of the software are partly missing. Also, the software integration to the existing system is in one go.
Detailed advantages and disadvantages of the Waterfall model are as follow:

ADVANTAGES OF THE WATERFALL MODEL:

The Waterfall model depends upon the sequential approach in which each stage should complete itself to start the next stage.
This consecutive order is suitable for smaller projects which are easy to start. The Waterfall model is a useful and predictable system if the requirements are clear, static, and well-documented. Furthermore, the Waterfall model is beneficial if the technology is mature and can easily be understood. The project should be short for the application of the Waterfall model.

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The development moves from concept, complete design, deployment, testing, installation, troubleshooting, and ends up in maintenance and operation.

Each phase of development has its own value and should be worked properly.

To understand the purpose and use of the Waterfall model, read the following advantages of this model carefully.

WATERFALL MODEL USES CLEAR STRUCTURE:

If you compare the Waterfall model with other **Software Development** Methodologies, you will be able to analyze that the Waterfall model contains a clearest and specific set of steps.

It has a simple structure based on the following steps:

System Requirements

Software Requirements

Requirements Analysis

Program Design

Implementation or Deployment

Testing

Launch

Each step should be completed by the team before moving onto the next step. This is helpful because errors can be detected at each step. Any roadblock to completion indicated and can be resolved right away. Leaving a partial project is less likely to push aside. Once a project starts it must pass all the stages to complete and become a polished project.

Besides being clear, the advancement of the Waterfall model is more spontaneous. Waterfall does not require specific training or certification for project managers or employees unlike Scrum or Six Sigma. The process should have clear requirements and a well-known methodology.

By this, the team members would be able to hop to the Waterfall system to proceed further.

EASY TO MANAGE AND CONTROL:

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The section division in the Waterfall makes it easier to handle. Each phase has its own reliability and procedures. From which each phase completes and processes one at a time without overlapping. Moreover, phases as an individual have specific deliverable and review processes. Due to the clarity of all the stages, the Waterfall is easy to use and manage. All the tasks can be arranged easily by following the hierarchy.

EARLY END-GOAL DETERMINATION:

It is a defining feature of the Waterfall system that it commits to a goal and specifies the product at the beginning stages. The team must follow the hierarchy and should avoid deviating from the system. For small projects, the team working on the Waterfall is fully aware of the overall goal from the beginning. There is a less possibility of getting lost in detail as the scheme moves forward. Calculation of the deadline depends upon the duration and completion of each phase. The release date of the product and the final cost can be calculated prior to the development.

Despite scrum, which divides the project into different individual sprints, the Waterfall focuses only on the end goal. A waterfall is an excellent approach for the projects having a concrete goal. Because it eliminates the risk of getting stuck in a project.

HIGH VISIBILITY:

The output in the Waterfall model, after each phase, creates high visibility. By analyzing the output of each stage, it can be determined by the project manager and client that the project is making considerable progress.

REDUCED NUMBER OF PROBLEMATIC ISSUES:

As the Waterfall model has different phases, the output of each phase is analyzed before it is sent to the next phase.
This standard data supervision can reduce the risk of problematic issues.

THE INFORMATION IS WELL TRANSFERRED:

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The approach of Waterfall is extremely systematic which makes the clean transfer of information at each phase or step. An organization with the right process can maximize the benefits of the Waterfall.

QUALITY ASSURANCE TESTS:

Quality assurance tests are performed before the completion of each phase.

This includes validation and verification.

If an error occurs on a certain stage, it is removed instantly, and the problem gets resolved.

DISADVANTAGES OF THE WATERFALL MODEL

The Waterfall model is the first sequential approach to **Software Development** based on traditional methods due to which it has been criticized for being outdated.

The size, type, and the goal of the project make the limitations of this methodology more apparent.

The Waterfall method should be thoroughly analyzed to know whether it is suitable for the project or not.

The analysis can be done by considering the limitations of the Waterfall project.

MAKING CHANGES CAN BE PROBLEMATIC:

The Waterfall model entirely depends on the sequential steps which make the team move forward.

The Waterfall methodology is a traditional approach which leaves almost no room for revisions or changes after completion of each step. Changes are only possible during the processing of the stage. If all the steps have been performed very carefully yet any unplanned roadblock appears after completion of the project, then there would be no way for pivoting. Once the developed application reaches the testing stage, it is almost impossible to go back and do alteration in anything.

The team working on the **Waterfall Project** must put a considerable amount of work into the project under very precise rigid assumptions. Any sudden change to the parameters can disturb the whole project which can waste a lot of time.

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If the requirements of any project are not static and involve frequent changing, then the Waterfall should be adapted to allow more room for revisions. Focusing on the end would become a second priority. This not only saves time but also the work efforts of the team.

DELAYED TESTING UNTIL AFTER COMPLETION:

The testing cannot be delayed until the half last of the project as it can be risky. Testing phase comes late in the developmental process and Waterfall insists the testing to be done until the stage arrives. In Waterfall, project testing takes considerable time to complete due to which large revisions can cause substantial delays.

Due to this limitation, Agile Methodology was created as it was felt by the critics of Waterfall that model contains too much room for the unnoticed problems. If frequent changes are required in any project, then different project methodology should be used for that.

WATERFALL EXCLUDE THE CLIENT/USER:

The main purpose of the Waterfall Methodology is to help the internal team to move more proficiently through the project phases.
As it is an internal process the focus on the involvement of end client in the project is very little. The clients often show their involvement concerns in the project to give an opinion and clarify their requirements.

HIGH AMOUNT OF RISK AND UNCERTAINTY:

The waterfall process does not perform step-wise testing, therefore, any issue can cause a lot of problems later. As there is no turning back, once a mistake has been made it can not be resolved in the next phase.

INTEGRATION IS AT THE END:

Integration is an end process which prevents the identification of any technological or business bottleneck. It may also challenge the process at the early stages.

NOT SUITABLE FOR COMPLEX PROJ

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Waterfall Model does not test complex and object-oriented models at every stage. Moreover, it does not remove the error during the process. Waterfall model, testing phase is the only stage which detects the error. Prior to the testing stage, there is no way to test if there are any mistakes or not.

This is a major drawback of the Waterfall model because projects with moderate or high requirements are at increased risk of changing which cannot be done with this model.

Due to the drawbacks of the Waterfall model, software analysts and designers developed a new method known as "Agile Model".

The Agile Scrum methodology has an advantage over all the limitations of the Waterfall model.

Because the projects which need frequent changes can be handled easily with Agile methodology. Moreover, Agile keeps the stakeholders informed throughout the life-cycle of the project.

WHAT IS AGILE METHODOLOGY AND WHY IS IT MORE RELIABLE?

The **Agile Methodology** is an alternative to the Waterfall method and is a very realistic development approach.

Unlike the Waterfall methodology, Agile is extremely dependent on initial requirements and on the idea of the final product.

Agile model is a combination of two SDLC models (iterative and incremental).

It has several components. The client can request to check the project at any stage. The Agile model put stress on collaboration as the developers, testers, and client work together until the end of the project.

Thus, Agile is all about "Agility" and its software development methods consider to be high revenue promoters for the product companies.

WHY AGILE IS USED MORE OFTEN?

To know about the superiority of Agile over Waterfall methodology, look on the advantages of Agile development method.

RELIABILITY AND FLEXIBILITY:

Agile model is more reliable than Waterfall because it segregates the development life-cycle into "sprints". It is more flexible than the Waterfall model.

Furthermore, Agile methodology is a combination of multiple projects due to which it focuses more on the overall software quality.

EASY TO CHANGE:

Agile allows changes at any stage of the software development process.

Waterfall completes the development phases only once which complicates the system in the presence of an error. These development stages include designing, development, and testing etc. Whereas Agile follows an iterative approach in which developmental phases appears more than once and changing is easy.

ANY STAGE IS TESTABLE:

The specific approach towards quality and testing differentiate Agile from the Waterfall model.

Because in Waterfall model testing phase comes after processing phase but in Agile testing can be made at any stage. Testing and programming can go simultaneously.

ALLOWS CLIENT'S PARTICIPATION:

The Waterfall model is an internal process whereas the Agile model cooperates with the client's participation. The focus of Agile is to provide customer satisfaction by allowing customer participation in the project.

TEAMWORK:

The Waterfall project is sequential whereas the Agile model is a highly cooperative software development process.

Agile is healthier for better team input and problem-solving procedures. The projects with clearly defined requirements and without expected changes are suit...

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application. While the Agile model supports the projects in which requirements evolve and need changes. Thus, if the development of software requires frequent overhauls then Agile is the best approach to follow. Besides, Agile ensures customer satisfaction as its top priority.

All the SDLC models are applicable for **Software Development** to some extent. It is the requirement of the project which selects which model would be best for it.

CONTACT INFO

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