Choice of Process Model:

'The word "process* is sometimes used to emphasize the idea of a system in action. In order to achieve an outcome, the system will have to execute one or more activities: this is its process. This idea can be applied to the development of computer-based systems where a number of interrelated activities have to be undertaken to create a linal product. These activities can be organized in different ways and we can call these process models.

A major part of the planning will be the choosing of the development methods to be used and the slotting of these into an overall process model.

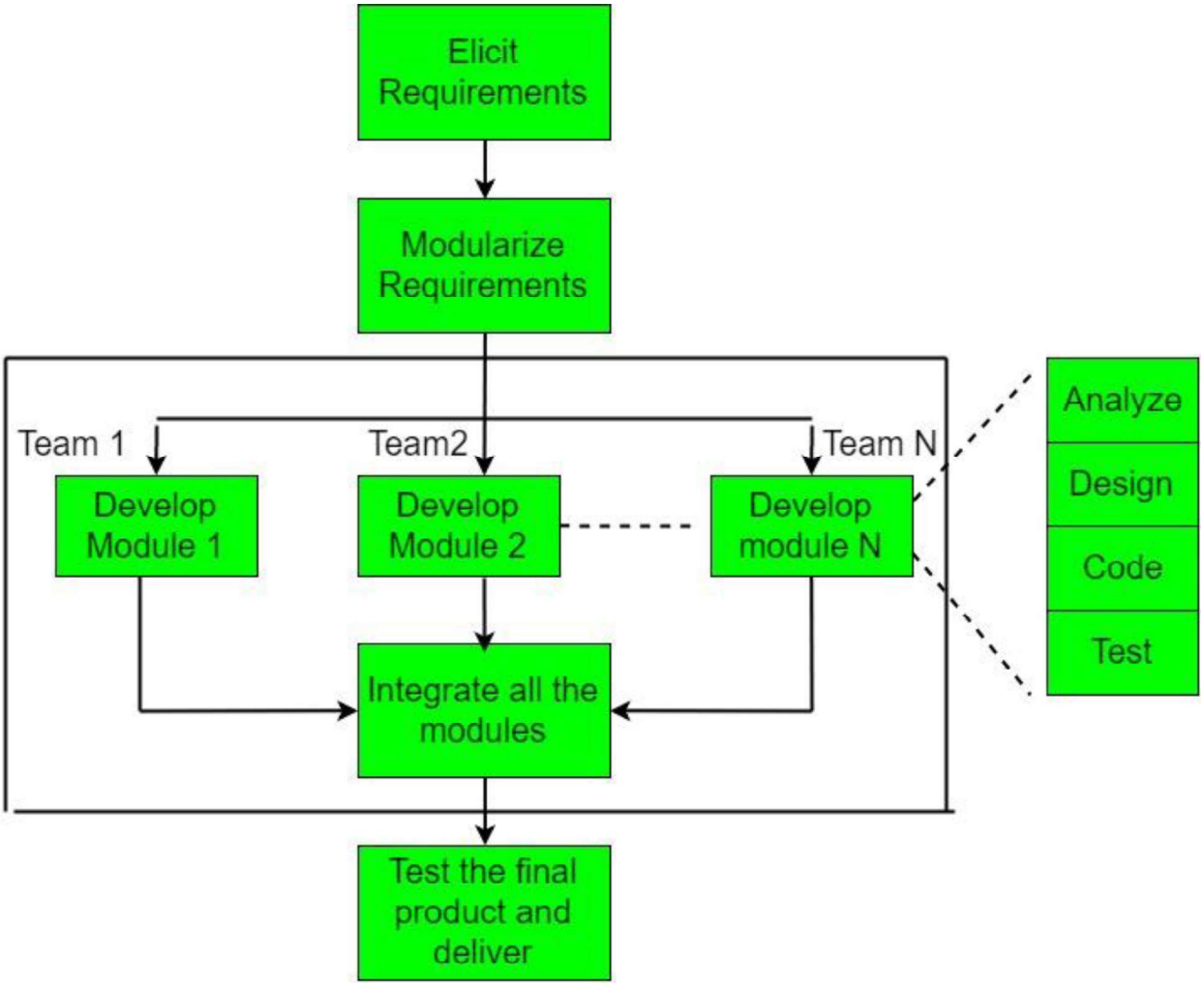
The planner needs not only to select methods but also to specify how the method is to be applied. With methods such as SSADM, there is a considerable degree of choice about how it is to be applied: not all parts of SSADM are compulsory. Many student projects have the rather basic failing that at the planning stage they claim that. say. SSADM is to be used: in the event, all that is produced are a few SSADM fragments such as a top level data flow diagram and a preliminary logical data structure diagram. If this is all the particular project requires, it should be stated at the outset.

Structured Method:

Although some 'object-oriented* specialists may object(!). we include the (X) approach as a structured method - after all. we hope it is not unstructured. Structured methods are made up of sets of steps and rules, w hich, when applied produce system products such as data flow diagrams. Each of these products is carefully documented. Such methods are often time consuming compared to more intuitive approaches and this implies some additional cost. The pay-off is such things as a less error prone and more maintainable final system. This balance of costs and benefits is more likely to be justified on a large project involving many developers and users. This is not to say that smaller projects cannot justify the use of such methods.

Rapid Application Development:

The Rapid Application Development Model was first proposed by IBM in the 1980s. The critical feature of this model is the use of powerful development tools and techniques. A software project can be implemented using this model if the project can be broken down into small modules wherein each module can be assigned independently to separate teams. These modules can finally be combined to form the final product. Development of each module involves the various basic steps as in the waterfall model i.e analyzing, designing, coding, and then testing, etc. as shown in the figure. Another striking feature of this model is a short time span i.e the time frame for delivery(time-box) is generally 60-90 days.



The use of powerful developer tools such as JAVA, C++, Visual BASIC, XML, etc. is also an integral part of the projects. This model consists of 4 basic phases:

1. **Requirements Planning –** It involves the use of various techniques used in requirements elicitation like brainstorming, task analysis, form analysis, user scenarios, FAST (Facilitated Application Development Technique), etc. It also consists of the entire structured plan describing the critical data, methods to obtain it, and then processing it to form a final refined model.
2. **User Description –** This phase consists of taking user feedback and building the prototype using developer tools. In other words, it includes re-examination and validation of the data collected in the first phase. The dataset attributes are also identified and elucidated in this phase.
3. **Construction –** In this phase, refinement of the prototype and delivery takes place. It includes the actual use of powerful automated tools to transform process and data models into the final working product. All the required modifications and enhancements are too done in this phase.
4. **Cutover –** All the interfaces between the independent modules developed by separate teams have to be tested properly. The use of powerfully automated tools and subparts makes testing easier. This is followed by acceptance testing by the user.

The process involves building a rapid prototype, delivering it to the customer, and taking feedback. After validation by the customer, the SRS document is developed and the design is finalized.

When to use RAD Model?

When the customer has well-known requirements, the user is involved throughout the life cycle, the project can be time boxed, the functionality delivered in increments, high performance is not required, low technical risks are involved and the system can be modularized. In these cases, we can use the RAD Model.

Advantages:

- The use of reusable components helps to reduce the cycle time of the project.
- Feedback from the customer is available at the initial stages.
- Reduced costs as fewer developers are required.
- The use of powerful development tools results in better quality products in comparatively shorter time spans.
- The progress and development of the project can be measured through the various stages.
- It is easier to accommodate changing requirements due to the short iteration time spans.

Disadvantages:

- The use of powerful and efficient tools requires highly skilled professionals.
- The absence of reusable components can lead to the failure of the project.
- The team leader must work closely with the developers and customers to close the project in time.
- The systems which cannot be modularized suitably cannot use this model.
- Customer involvement is required throughout the life cycle.
- It is not meant for small-scale projects as in such cases, the cost of using automated tools and techniques may exceed the entire budget of the project.

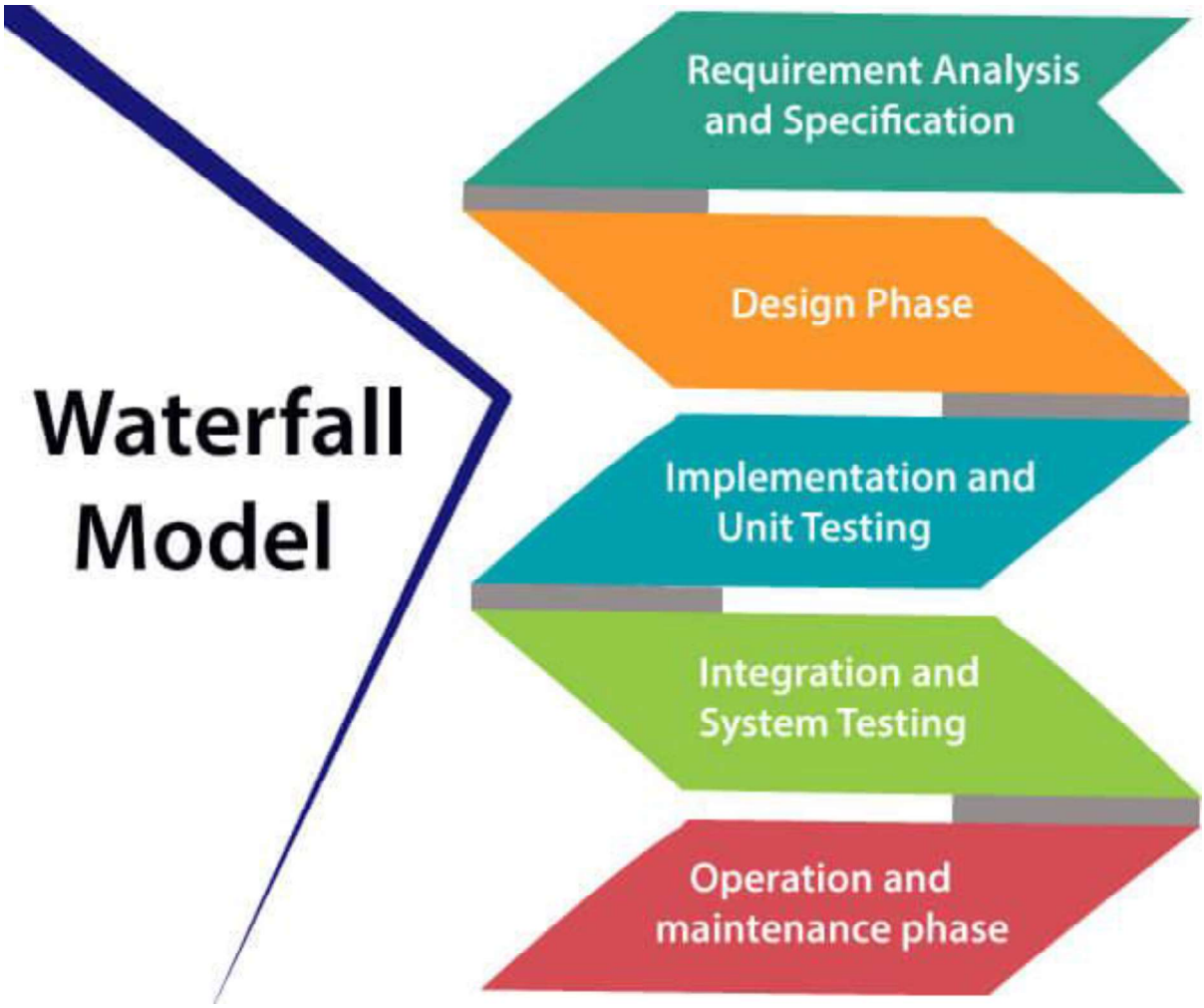
Applications:

1. This model should be used for a system with known requirements and requiring a short development time.
2. It is also suitable for projects where requirements can be modularized and reusable components are also available for development.
3. The model can also be used when already existing system components can be used in developing a new system with minimum changes.
4. This model can only be used if the teams consist of domain experts. This is because relevant knowledge and the ability to use powerful techniques are a necessity.
5. The model should be chosen when the budget permits the use of automated tools and techniques required.

Waterfall Model:

Winston Royce introduced the Waterfall Model in 1970.This model has five phases: Requirements analysis and specification, design, implementation, and unit testing, integration and system testing, and operation and maintenance. The steps always follow in this order and do not overlap. The developer must complete every phase before the next phase begins. This model is named "**Waterfall Model**", because its diagrammatic representation resembles a cascade of waterfalls.

1. Requirements analysis and specification phase: The aim of this phase is to understand the exact requirements of the customer and to document them properly. Both the customer and the software developer work together so as to document all the functions, performance, and interfacing requirement of the software. It describes the "what" of the system to be produced and not "how."In this phase, a large document called **Software Requirement Specification (SRS)** document is created which contained a detailed description of what the system will do in the common language.



2. Design Phase: This phase aims to transform the requirements gathered in the SRS into a suitable form which permits further coding in a programming language. It defines the overall

software architecture together with high level and detailed design. All this work is documented as a Software Design Document (SDD).

3. Implementation and unit testing: During this phase, design is implemented. If the SDD is complete, the implementation or coding phase proceeds smoothly, because all the information needed by software developers is contained in the SDD.

During testing, the code is thoroughly examined and modified. Small modules are tested in isolation initially. After that these modules are tested by writing some overhead code to check the interaction between these modules and the flow of intermediate output.

4. Integration and System Testing: This phase is highly crucial as the quality of the end product is determined by the effectiveness of the testing carried out. The better output will lead to satisfied customers, lower maintenance costs, and accurate results. Unit testing determines the efficiency of individual modules. However, in this phase, the modules are tested for their interactions with each other and with the system.

5. Operation and maintenance phase: Maintenance is the task performed by every user once the software has been delivered to the customer, installed, and operational.

When to use SDLC Waterfall Model?

Some Circumstances where the use of the Waterfall model is most suited are:

- When the requirements are constant and not changed regularly.
- A project is short
- The situation is calm
- Where the tools and technology used is consistent and is not changing
- When resources are well prepared and are available to use.

Advantages of Waterfall model

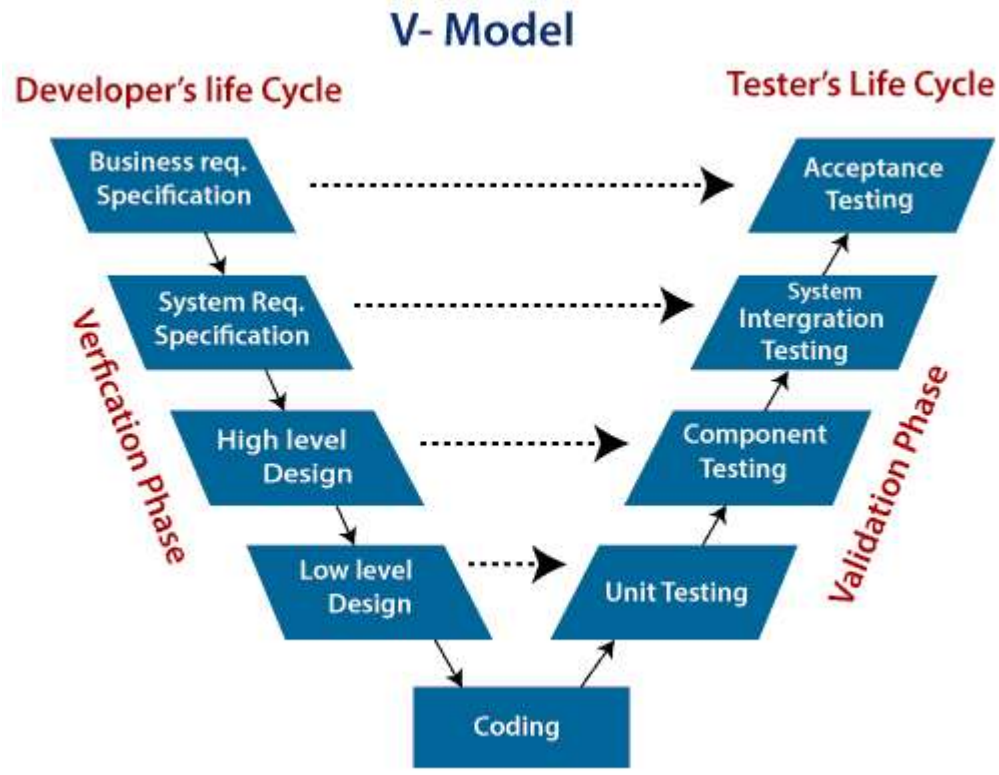
- This model is simple to implement also the number of resources that are required for it is minimal.
- The requirements are simple and explicitly declared; they remain unchanged during the entire project development.
- The start and end points for each phase is fixed, which makes it easy to cover progress.
- The release date for the complete product, as well as its final cost, can be determined before development.
- It gives easy to control and clarity for the customer due to a strict reporting system.

Disadvantages of Waterfall model

- In this model, the risk factor is higher, so this model is not suitable for more significant and complex projects.
- This model cannot accept the changes in requirements during development.
- It becomes tough to go back to the phase. For example, if the application has now shifted to the coding phase, and there is a change in requirement, It becomes tough to go back and change it.
- Since the testing done at a later stage, it does not allow identifying the challenges and risks in the earlier phase, so the risk reduction strategy is difficult to prepare.

V-Process Model:

V-Model also referred to as the Verification and Validation Model. In this, each phase of SDLC must complete before the next phase starts. It follows a sequential design process same as the waterfall model. Testing of the device is planned in parallel with a corresponding stage of development.



Verification: It involves a static analysis method (review) done without executing code. It is the process of evaluation of the product development process to find whether specified requirements meet.

Validation: It involves dynamic analysis method (functional, non-functional), testing is done by executing code. Validation is the process to classify the software after the completion of the

development process to determine whether the software meets the customer expectations and requirements.

So V-Model contains Verification phases on one side of the Validation phases on the other side. Verification and Validation process is joined by coding phase in V-shape. Thus it is known as V-Model.

There are the various phases of Verification Phase of V-model:

1. **Business requirement analysis:** This is the first step where product requirements understood from the customer's side. This phase contains detailed communication to understand customer's expectations and exact requirements.
2. **System Design:** In this stage system engineers analyze and interpret the business of the proposed system by studying the user requirements document.
3. **Architecture Design:** The baseline in selecting the architecture is that it should understand all which typically consists of the list of modules, brief functionality of each module, their interface relationships, dependencies, database tables, architecture diagrams, technology detail, etc. The integration testing model is carried out in a particular phase.
4. **Module Design:** In the module design phase, the system breaks down into small modules. The detailed design of the modules is specified, which is known as Low-Level Design
5. **Coding Phase:** After designing, the coding phase is started. Based on the requirements, a suitable programming language is decided. There are some guidelines and standards for coding. Before checking in the repository, the final build is optimized for better performance, and the code goes through many code reviews to check the performance.

There are the various phases of Validation Phase of V-model:

1. **Unit Testing:** In the V-Model, Unit Test Plans (UTPs) are developed during the module design phase. These UTPs are executed to eliminate errors at code level or unit level. A unit is the smallest entity which can independently exist, e.g., a program module. Unit testing verifies that the smallest entity can function correctly when isolated from the rest of the codes/ units.
2. **Integration Testing:** Integration Test Plans are developed during the Architectural Design Phase. These tests verify that groups created and tested independently can coexist and communicate among themselves.
3. **System Testing:** System Tests Plans are developed during System Design Phase. Unlike Unit and Integration Test Plans, System Tests Plans are composed by the

client?s business team. System Test ensures that expectations from an application developer are met.

4. **Acceptance Testing:** Acceptance testing is related to the business requirement analysis part. It includes testing the software product in user atmosphere. Acceptance tests reveal the compatibility problems with the different systems, which is available within the user atmosphere. It conjointly discovers the non-functional problems like load and performance defects within the real user atmosphere.

When to use V-Model?

- When the requirement is well defined and not ambiguous.
- The V-shaped model should be used for small to medium-sized projects where requirements are clearly defined and fixed.
- The V-shaped model should be chosen when sample technical resources are available with essential technical expertise.

Advantage (Pros) of V-Model:

1. Easy to Understand.
2. Testing Methods like planning, test designing happens well before coding.
3. This saves a lot of time. Hence a higher chance of success over the waterfall model.
4. Avoids the downward flow of the defects.
5. Works well for small plans where requirements are easily understood.

Disadvantage (Cons) of V-Model:

1. Very rigid and least flexible.
2. Not a good for a complex project.
3. Software is developed during the implementation stage, so no early prototypes of the software are produced.
4. If any changes happen in the midway, then the test documents along with the required documents, has to be updated.

Spiral Model:

The spiral model, initially proposed by Boehm, is an evolutionary software process model that couples the iterative feature of prototyping with the controlled and systematic aspects of the linear sequential model. It implements the potential for rapid development of new versions of