Advanced Software Development Methodologies

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- Git
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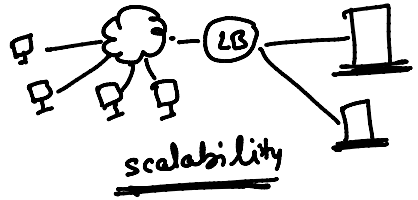
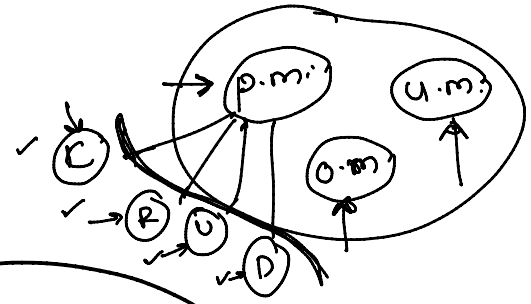
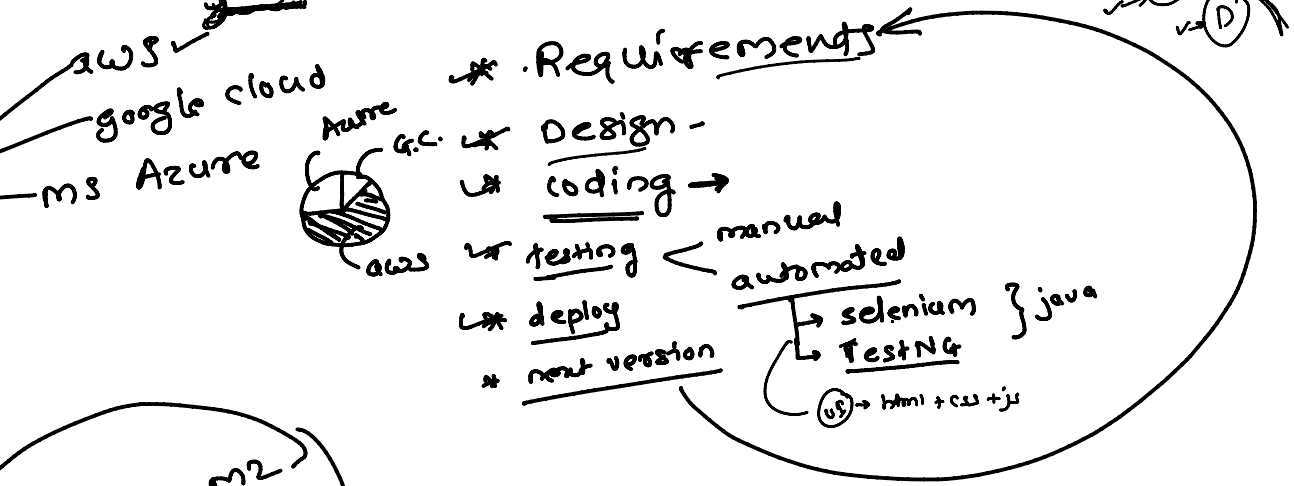
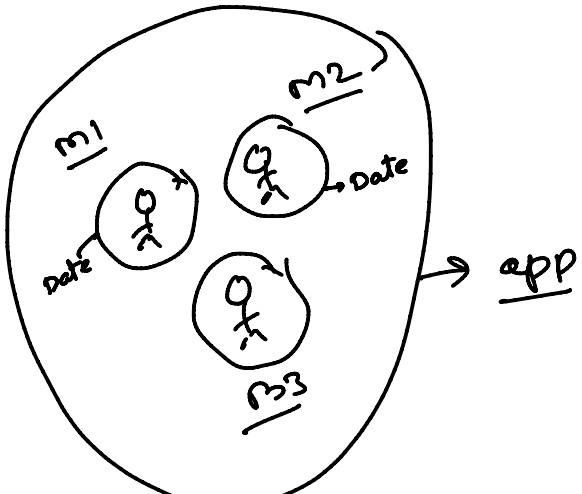
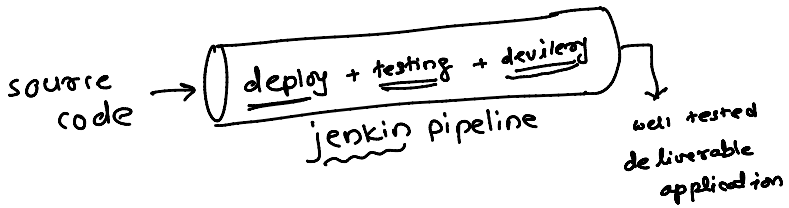
- DevOps

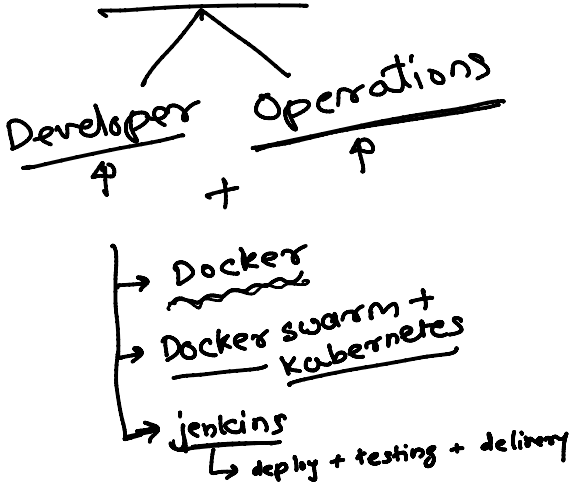












Software Engineering

Software Engineering

- Software = program + libraries + documentation
  - A program which serves some computational purpose
  - Collection of executable programming code, associated libraries and documentations
- Engineering
  - All about developing products using well defined principles, methods and procedures

→

① dev. ② deploy ③ maintain

Software Engineering

- Associated with development of software product (application) using well defined scientific principles, methods and procedures
- The application of a systematic, disciplined , quantifiable approach to the development, operation and maintenance of software
- Establishment and use of sound engineering principles in order to obtain software that is reliable and work efficiently on real machines

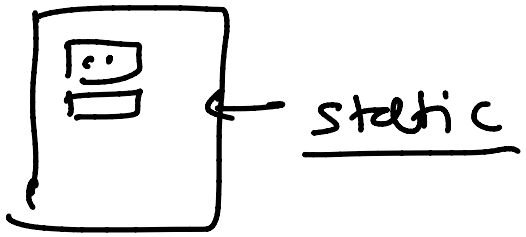
Software Evaluation

- The process of developing a software product using software engineering principles and methods
- includes
  - the initial development of software
  - its maintenance and updates, till desired software product is developed
- Includes different phases like requirement gathering, development, testing, deployment etc

Software Evaluation

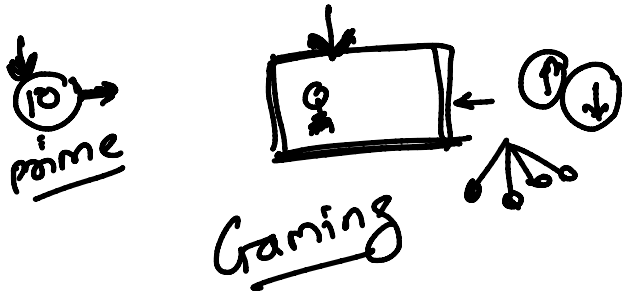
- Software Types
  - S-Type
  - P-Type
  - E-Type

S-Type software



- Static type → never changing
- Works strictly according to the pre-defined specifications and solutions
- Solution and method to achieve it can be understood immediately before coding starts
- Least subjected to the changes
- Simplest of all
- E.g.
  - Calculator program for mathematical computation

P-Type Software



- Practical type
- Collection of different procedures
- Is defined by exactly what procedures can do
- The specification can e described and solutions are not obvious instantly
- E.g.
  - Gaming software

E-Type software

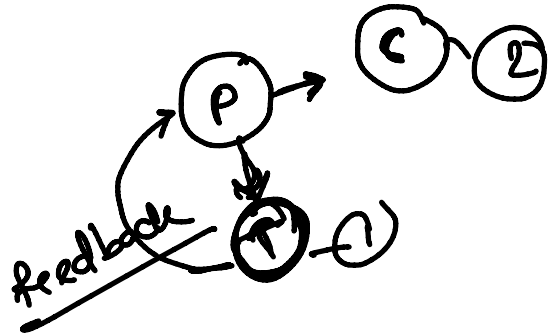
- Embedded Type
- Works closely as the requirement of real-world environment
- Has a high degree of evolution as there are various changes in laws, taxes etc. in the real world
- E.g.
  - Online trading software

E-Type software - laws

- **Continuing change**
  - must continue to adapt to the real world changes, else it becomes progressively less useful
- **Increasing complexity**
  - As an E-type software system evolves, its complexity tends to increase unless work is done to maintain or reduce it
- **Conservation of familiarity**
  - The familiarity with the software or the knowledge about how it was developed, why was it developed in that particular manner etc. must be retained at any cost, to implement the changes in the system

— KISS - keep it simple & stupid

E-Type software - laws



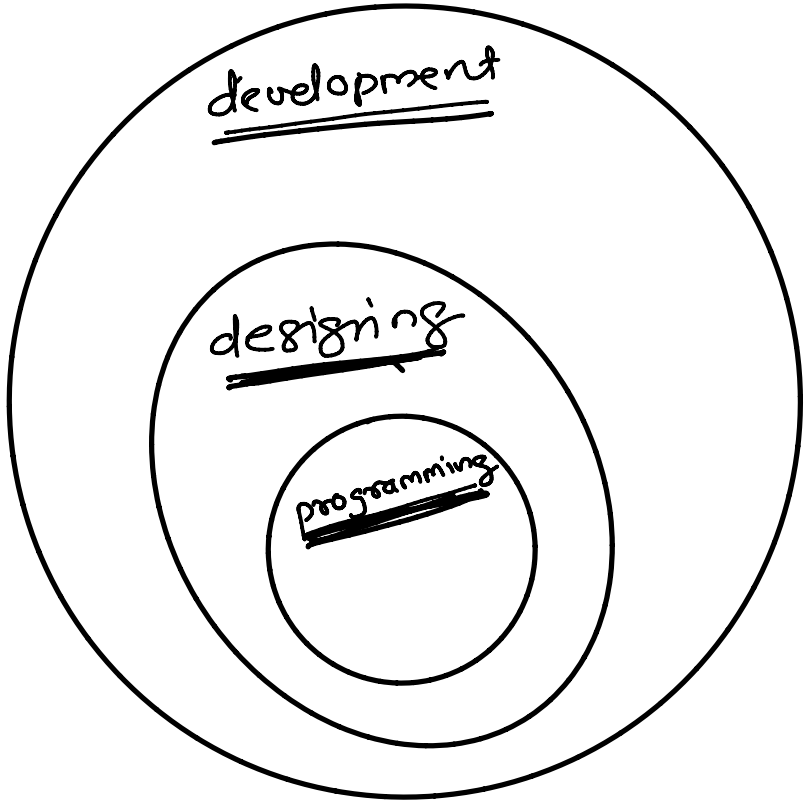
- **Continuing growth**
  - size of implementing the changes grows according to the lifestyle changes of the business
- **Reducing quality**
  - declines in quality unless rigorously maintained and adapted to a changing operational environment
- **Feedback systems**
  - constitute multi-loop, multi-level feedback systems and must be treated as such to be successfully modified or improved

E-Type software - laws

- **Self-regulation**
  - evolution processes are self-regulating with the distribution of product and process measures close to normal
- **Organizational stability**
  - The average effective global activity rate in an evolving E-type system is invariant over the lifetime of the product

Software Paradigms

- Methods and steps, which are taken while designing the software
- Can be divided into
  - Software Development Paradigm
  - Software Design Paradigm
  - Programming Paradigm

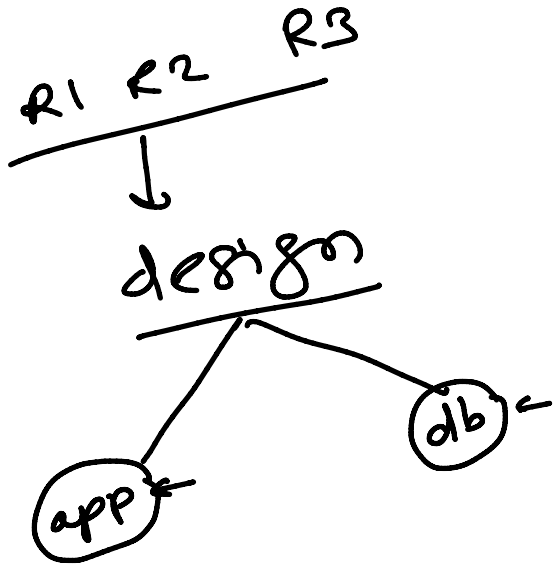


Software Development Paradigm

- Is known as software engineering paradigms where all the engineering concepts pertaining to the development of software are applied
- Includes various researches and requirement gathering which helps the software product to build
- Consists of
  - Requirement gathering
  - Software design
  - Programming

Software Design Paradigm

- Is a part of Software Development
- Consists of
  - Design
  - Maintenance
  - Programming



Programming Paradigm

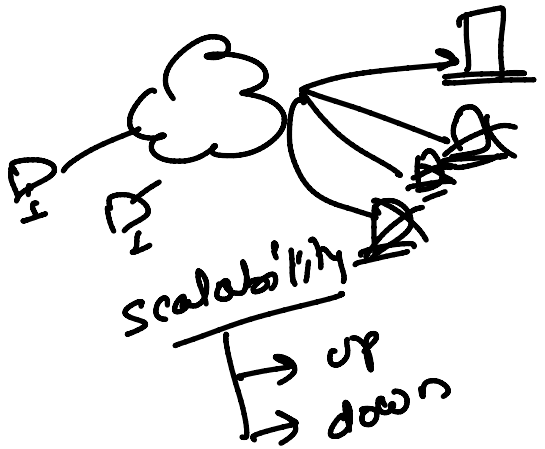
- Is related closely to programming aspect of software development
- Consists of
  - Coding
  - Testing
  - Integration → jenkins

Need of Software Engineering

- Large applications
- Scalability
- Cost
- Dynamic nature
- Quality management

AGILE

– E-type



Characteristics of good software

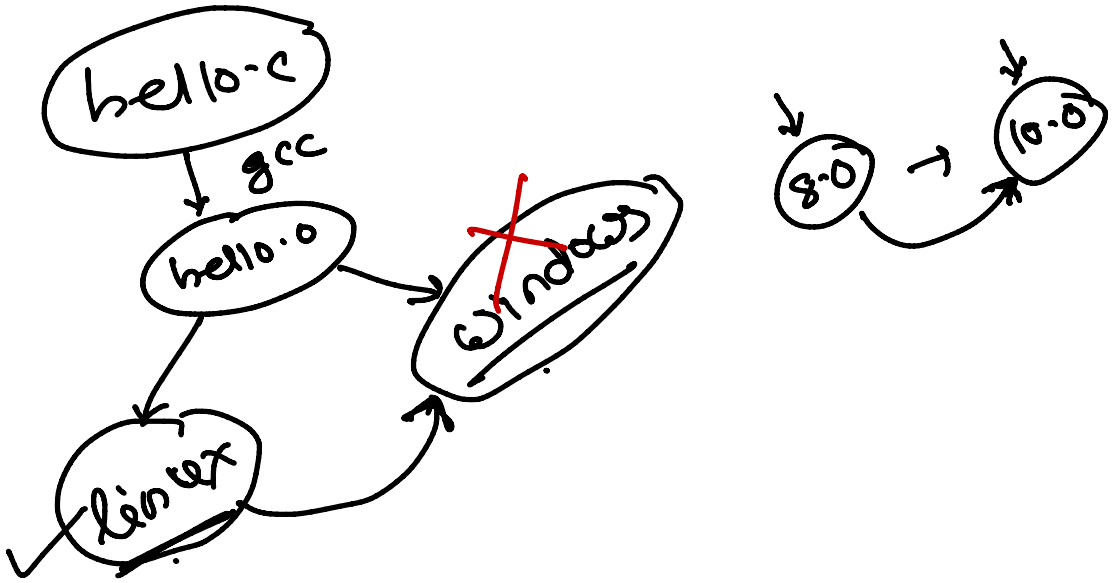
- A software product can be judged by what it offers and how well it can be used
- Well-engineered and crafted software is expected to have the following characteristics
  - Operational
  - Transactional
  - Maintenance

Operational

- This tells us how well software works in operations
- Can be measured on:
  - Budget
  - Usability
  - Efficiently
  - Correctness
  - Functionality
  - Dependability
  - Security — authentication
  - Safety

Transitional

- This aspect is important when the software is moved from one platform to another
- Can be measured on
  - Portability
  - Interoperability
  - Reusability
  - Adaptability



Maintenance

- Briefs about how well a software has the capabilities to maintain itself in the ever-changing environment
- Can be measured on
  - Modularity
  - Maintainability
  - Flexibility
  - Scalability

SDLC

Software Development Life Cycle

SDLC (SDP)

- Software Development Life Cycle
- Also called as Software Development Process
- Is a well-defined, structured sequence of stages in software engineering to develop the intended software product
- Is a framework defining tasks performed at each step in the software development process
- Aims to produce a high-quality software that
  - meets or exceeds customer expectations (client)
  - reaches completion within times and cost estimates

Organization

1. Client communication
   - negotiates
2. Software Architect
   - technology stack
     - frontend
     - backend
3. Project manager

$2m

client
e-commerce

SRS

designer
- UI designer
- UX designer

Dev
T.M
TL TL TL
D D D D D D

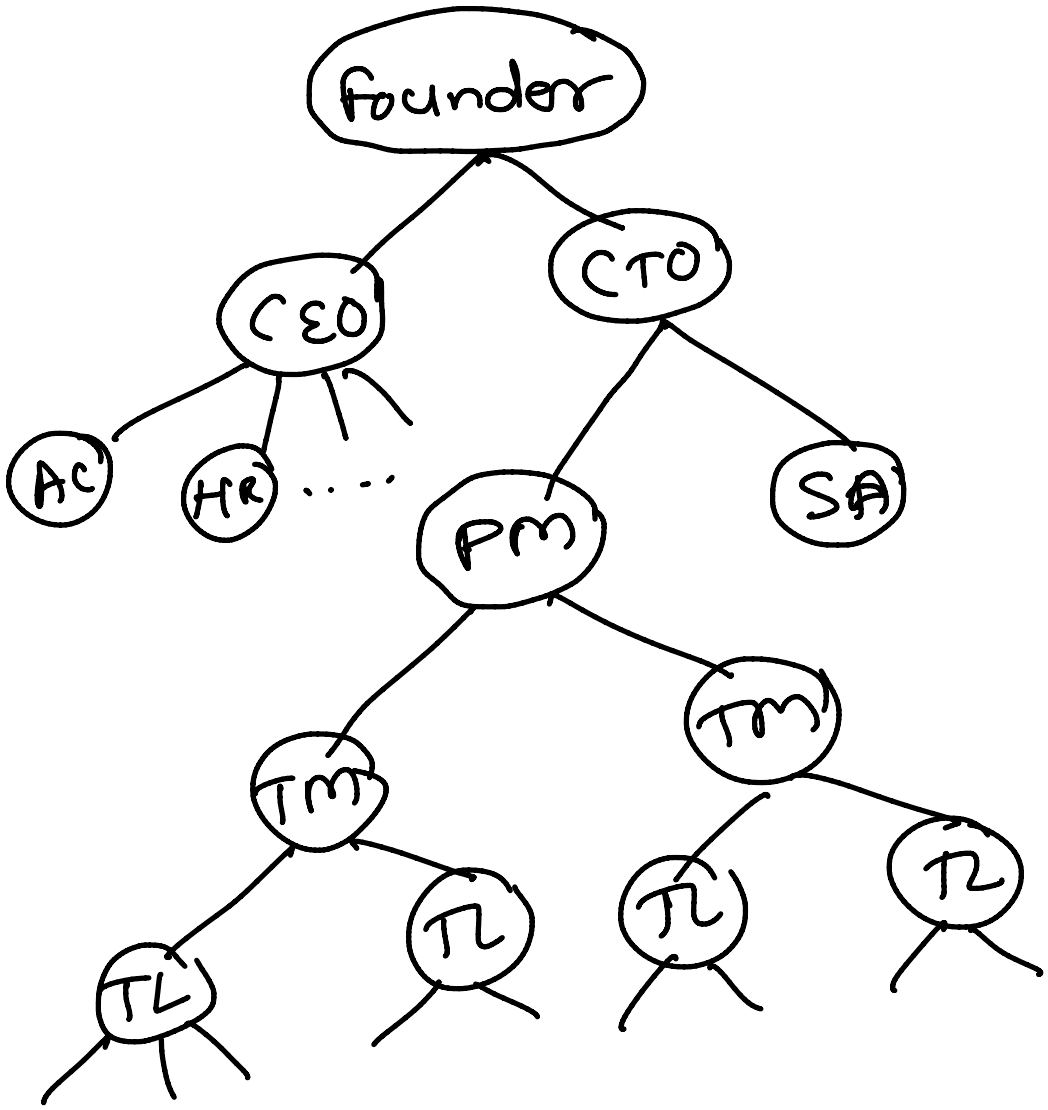
Testing
T.M
TL TL
T T T T

OPS
ad ad

End User

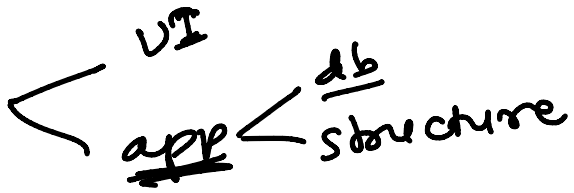
coder → developer

tester → tester


Founder
CEO
CTO
AC
HR
PM
SA
TM
TM
TL
TL
TL
TL

SDLC

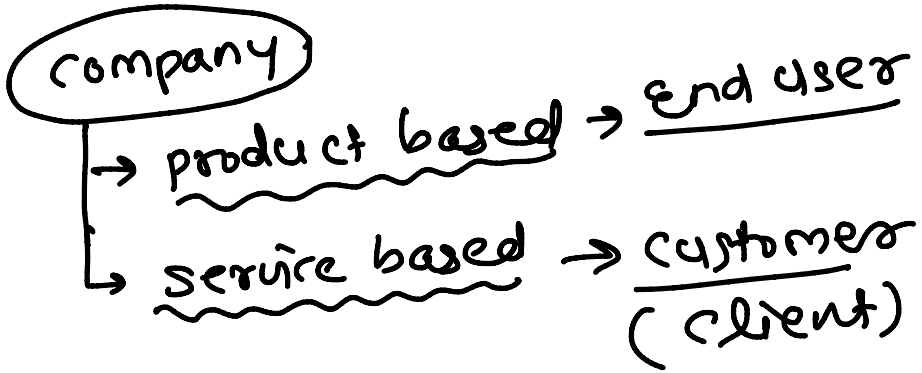
- Consists of detailed plan (stages) of describing how to develop, test, deploy and maintain the software product
- The stages are
  - Planning
  - Defining
  - Designing
  - Building
  - Testing
  - Deployment



Planning and Requirement Analysis

- The most important and fundamental stage in SDLC
- It is performed by the senior members of the team with inputs from the customer, the sales department, market surveys and domain experts in the industry
- This information is then used to plan the basic project approach and to conduct product feasibility study in the economical, operational and technical areas
- Planning for the quality assurance requirements and identification of the risks associated with the project is also done in the planning stage
- The outcome of the technical feasibility study is to define the various technical approaches that can be followed to implement the project successfully with minimum risks

Defining Requirements



- Once the requirement analysis is done the next step is to clearly define and document the product requirements and get them approved from the customer or the market analysts
- This is done through an **SRS (Software Requirement Specification)** document which consists of all the product requirements to be designed and developed during the project life cycle

E-commerce

(A) Admin Panel

1] Product management
- add product
- modify
  - price
  - metadata
- delete
- list

2] user management
- manage admin users
- block end user
- unblock end user
- send bills

3] Order management
- change order status
- close order
- suspend order

(B) End user

1] Product management
- list products
- add product to an order
- remove " " ...
- search product
- purchase a product

2] user management
- register a new account
- login to system
- close the account
- change profile

3] Order management
- create order
- cancel order
- pay

Designing the Product Architecture

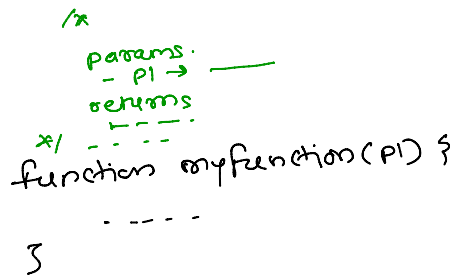
SRS / DDS

- SRS is the reference for product architects to come out with the best architecture for the product to be developed (SA)
- Based on the requirements specified in SRS, usually more than one design approach for the product architecture is proposed and documented in a DDS - Design Document Specification
- This DDS is reviewed by all the important stakeholders and based on various parameters as risk assessment, product robustness, design modularity, budget and time constraints, the best design approach is selected for the product

Designing the Product Architecture

- A design approach clearly defines all the architectural modules of the product along with its communication and data flow representation with the external and third party modules (if any)
- The internal design of all the modules of the proposed architecture should be clearly defined with the minutest of the details in DDS

Building or Developing the Product



- In this stage of SDLC the actual development starts and the product is built
- The programming code is generated as per DDS during this stage
- If the design is performed in a detailed and organized manner, code generation can be accomplished without much hassle
- Developers must follow the coding guidelines defined by their organization and programming tools like compilers, interpreters, debuggers, etc. are used to generate the code
- Different high level programming languages such as C, C++, Java, PHP etc. are used for coding
- The programming language is chosen with respect to the type of software being developed

Testing the Product

- This stage is usually a subset of all the stages as in the modern SDLC models
- The testing activities are mostly involved in all the stages of SDLC
- However, this stage refers to the testing only stage of the product where product defects are reported, tracked, fixed and retested, until the product reaches the quality standards defined in the SRS

Deployment in the Market and Maintenance

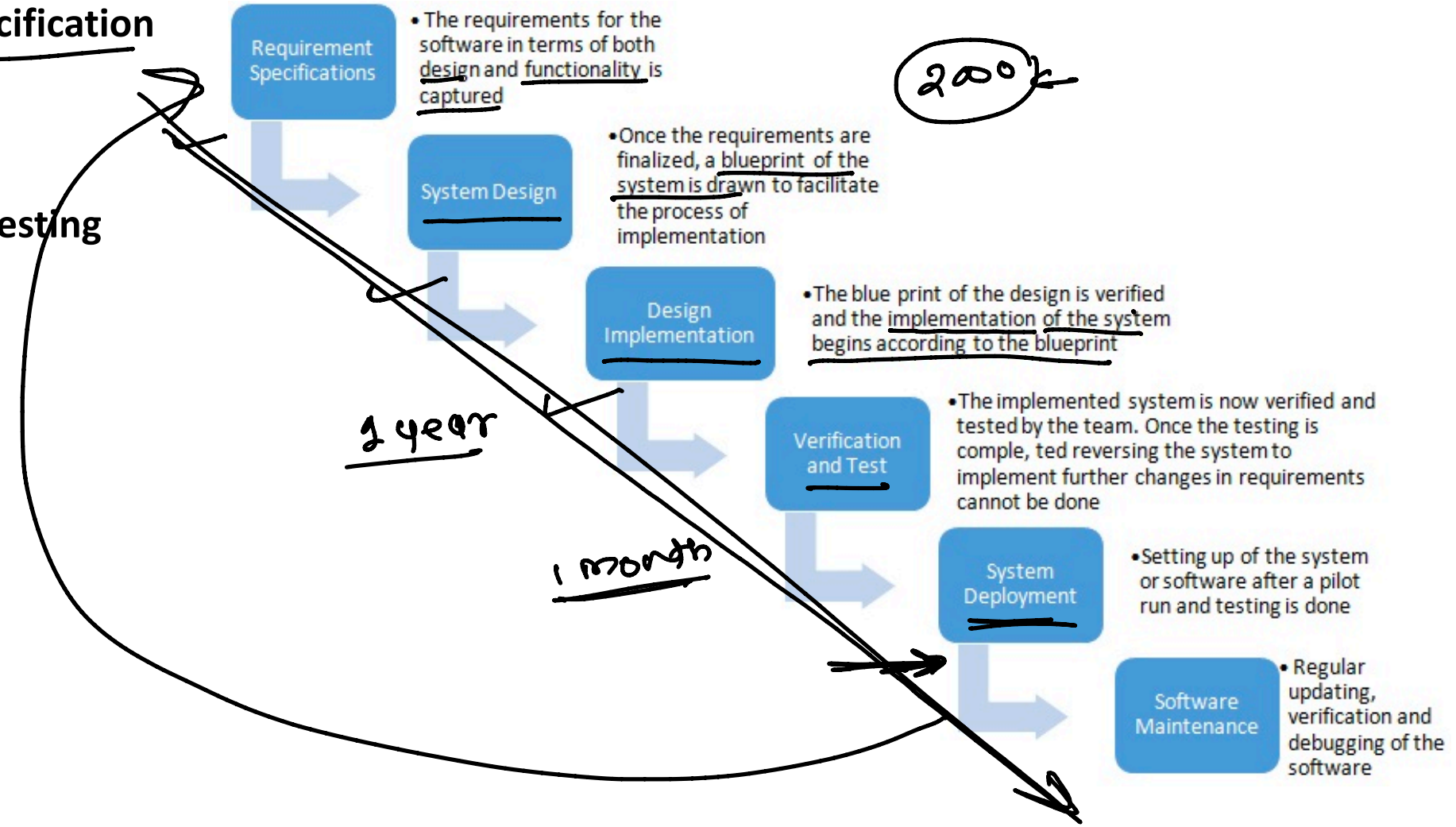
- Once the product is tested and ready to be deployed it is released formally in the appropriate market
- Sometimes product deployment happens in stages as per the business strategy of that organization
- The product may first be released in a limited segment and tested in the real business environment (UAT- User acceptance testing)
- Then based on the feedback, the product may be released as it is or with suggested enhancements in the targeting market segment
- After the product is released in the market, its maintenance is done for the existing customer base

SDLC Models

- There are various software development life cycle models defined and designed which are followed during the software development process
- Also referred as Software Development Process Models
- Models
  - Waterfall Model
  - Iterative Model
  - Spiral Model
  - V-Model
  - Big Bang Model
  - Agile Model

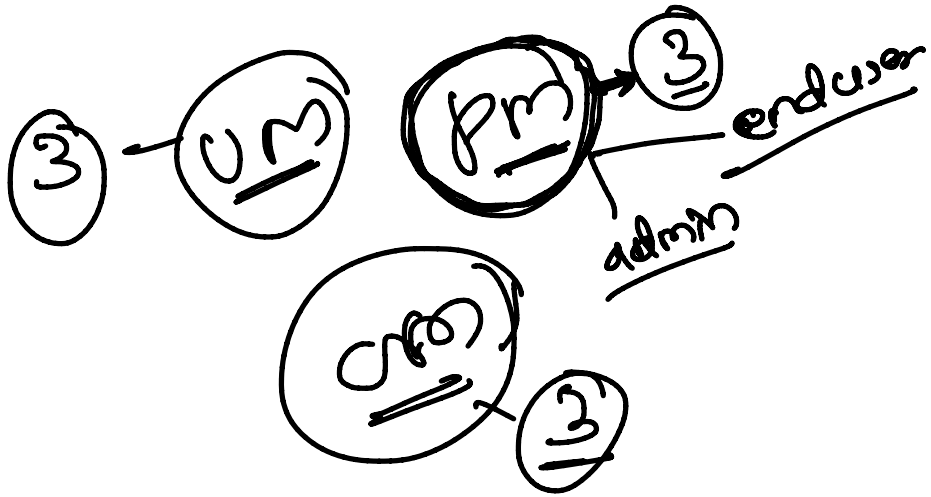
Waterfall Model

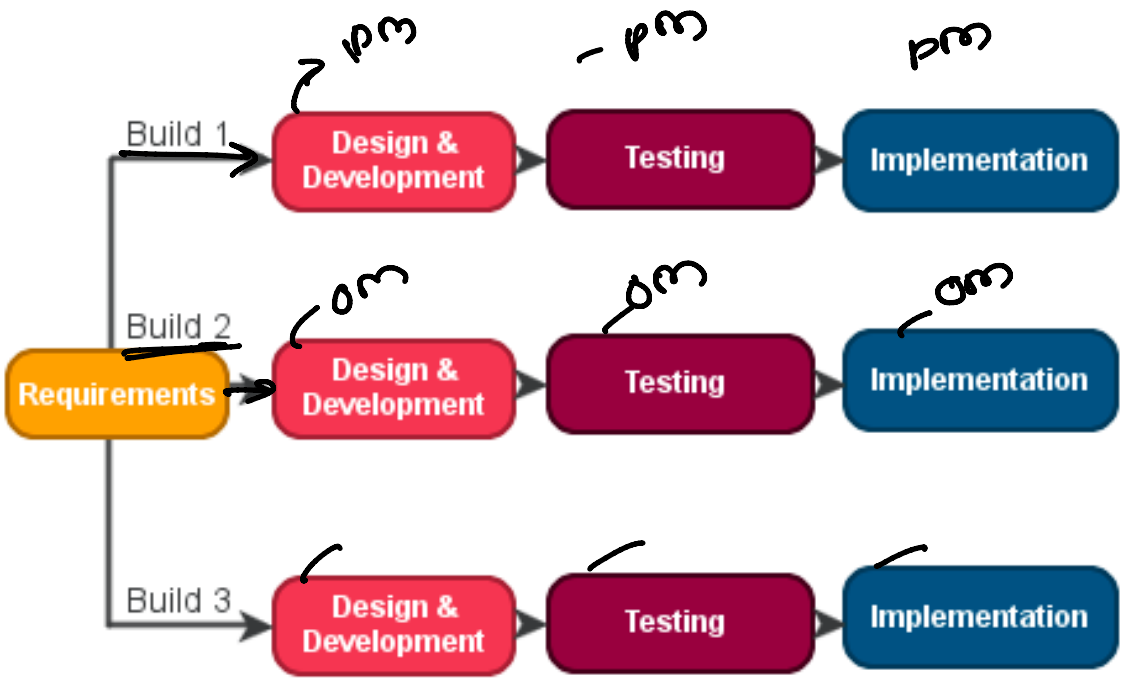
- **Requirement Specification**
- **Design**
- **Implementation**
- **Verification and Testing**
- **Deployment**
- **Maintenance**



Iterative Model

- implementation of a subset of the software requirements and iteratively enhances the evolving versions until the full system is implemented



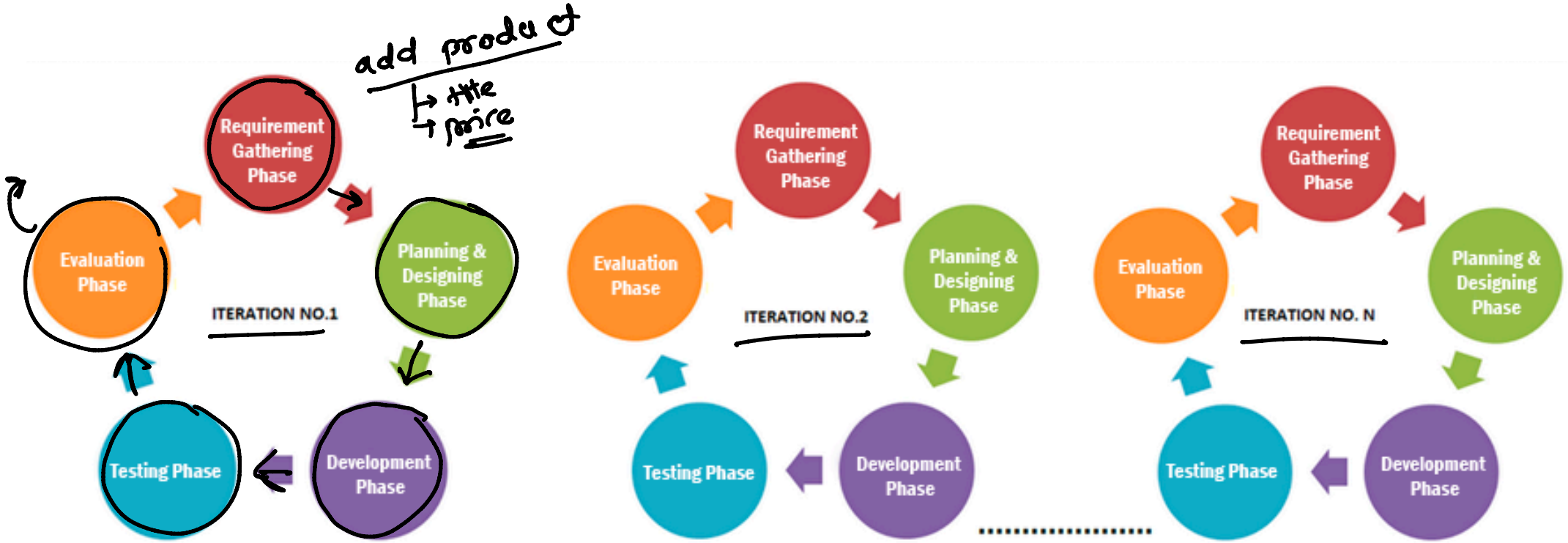


Agile Methodologies

Agile Methodologies

- Agile model believes that every project needs to be handled differently and the existing methods need to be tailored to best suit the project requirements
- The tasks are divided to time boxes (small time frames) to deliver specific features for a release
- Iterative approach is taken and working software build is delivered after each iteration
- Each build is incremental in terms of features; the final build holds all the features required by the customer

Agile Model



AGILE SOFTWARE DEVELOPMENT

Agile Manifesto

- **Individuals and interactions**
  - self-organization and motivation are important
- **Working software**
  - Demo working software is considered the best means of communication with the customers to understand their requirements, instead of just depending on documentations
- **Customer collaboration**
  - continuous customer interaction is very important to get proper product requirements
- **Responding to change**
  - focused on quick responses to change and continuous development

Agile Methodologies

- The most popular Agile methods include
  - Rational Unified Process
  - Scrum
  - Crystal Clear
  - Extreme Programming
  - Adaptive Software Development
  - Feature Driven Development
  - Dynamic Systems Development Method (DSDM)
  - Kanban

Agile Methodologies - Scrum

- Is an agile way to manage a project
- Management framework with far reaching abilities to control and manage the iterations and increments in all project types
- One of the implementations of agile methodology
- Incremental builds are delivered to the customer in every two to three weeks time
- Ideally used in the project where the requirement is rapidly changing

Agile Methodologies – Scrum Terminologies

- **Scrum:** a framework to support teams in complex product development
- **Scrum Board:** a physical board to visualize information for and by the Scrum Team, used to manage Sprint Backlog
- **Scrum Master:** the role within a Scrum Team accountable for guiding, coaching, teaching and assisting a Scrum Team and its environments in a proper understanding and use of Scrum
- **Scrum Team:** a self-organizing team consisting of a Product Owner, Development Team and Scrum Master
- **Self-organization:** the management principle that teams autonomously organize their work

Agile Methodologies – Scrum Terminologies

- **Sprint:** time-boxed event of 30 days, or less, that serves as a container for the other Scrum events and activities.
- **Sprint Backlog:** an overview of the development work to realize a Sprint's goal, typically a forecast of functionality and the work needed to deliver that functionality.
- **Sprint Goal:** a short expression of the purpose of a Sprint, often a business problem that is addressed
- **Sprint Retrospective:** time-boxed event of 3 hours, or less, to end a Sprint to inspect the past Sprint and plan for improvements

Sprint-time - 5 days

(A) Admin Panel

1] Product management
- 3 - add product
- 2 - modify (price, metadata)
- 3 - delete
- 4 - list

→ sprint -1

(M) → (F)

S2

2] user management
- 2 - manage admin users → backlog
- 1 - block end user
- 1 - unblock end user
- 2 - send bills

3) Order management
- 3 - change order status
- 2 - close order
- 1 - suspend order

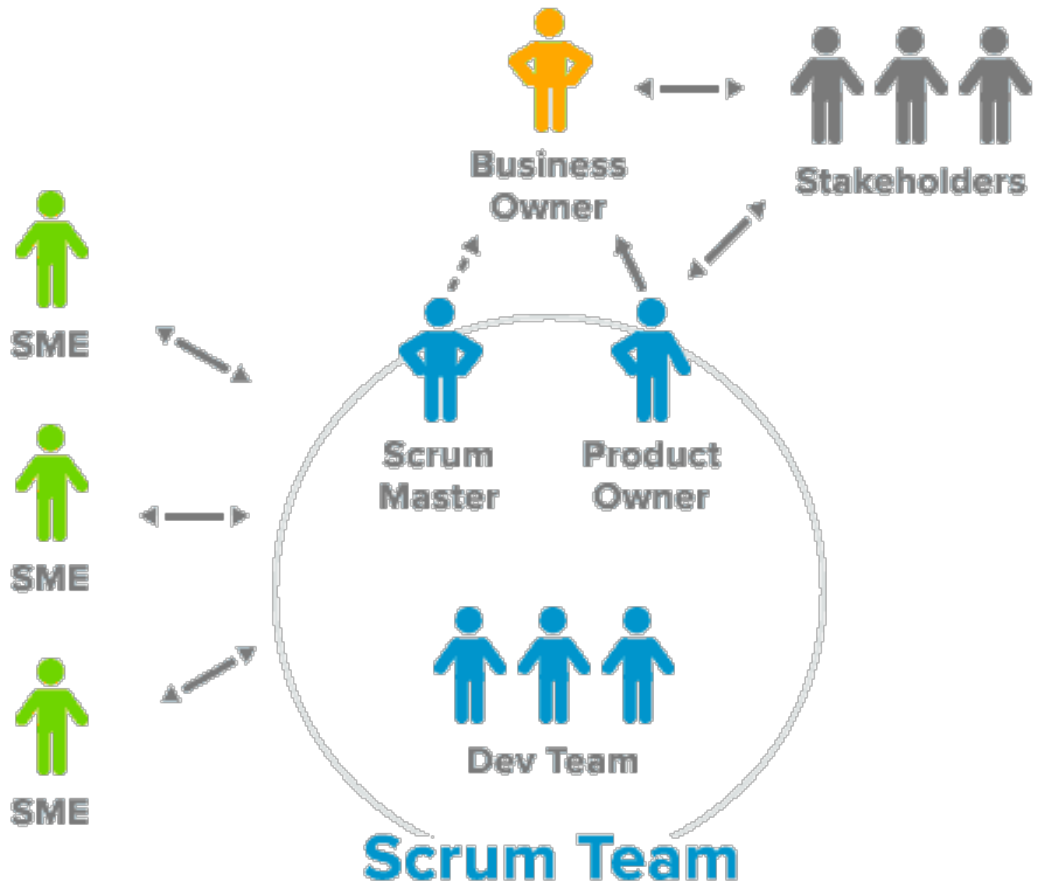
Agile Methodologies – Scrum Terminologies

- **Sprint Review:** time-boxed event of 4 hours, or less, to conclude the development work of a Sprint
- **Stakeholder:** a person external to the Scrum Team with a specific interest in and knowledge of a product that is required for incremental discovery
- **Development Team:** the role within a Scrum Team accountable for managing, organizing and doing all development work
- **Daily Scrum:** daily time-boxed event of 15 minutes for the Development Team to re-plan the next day of development work during a Sprint

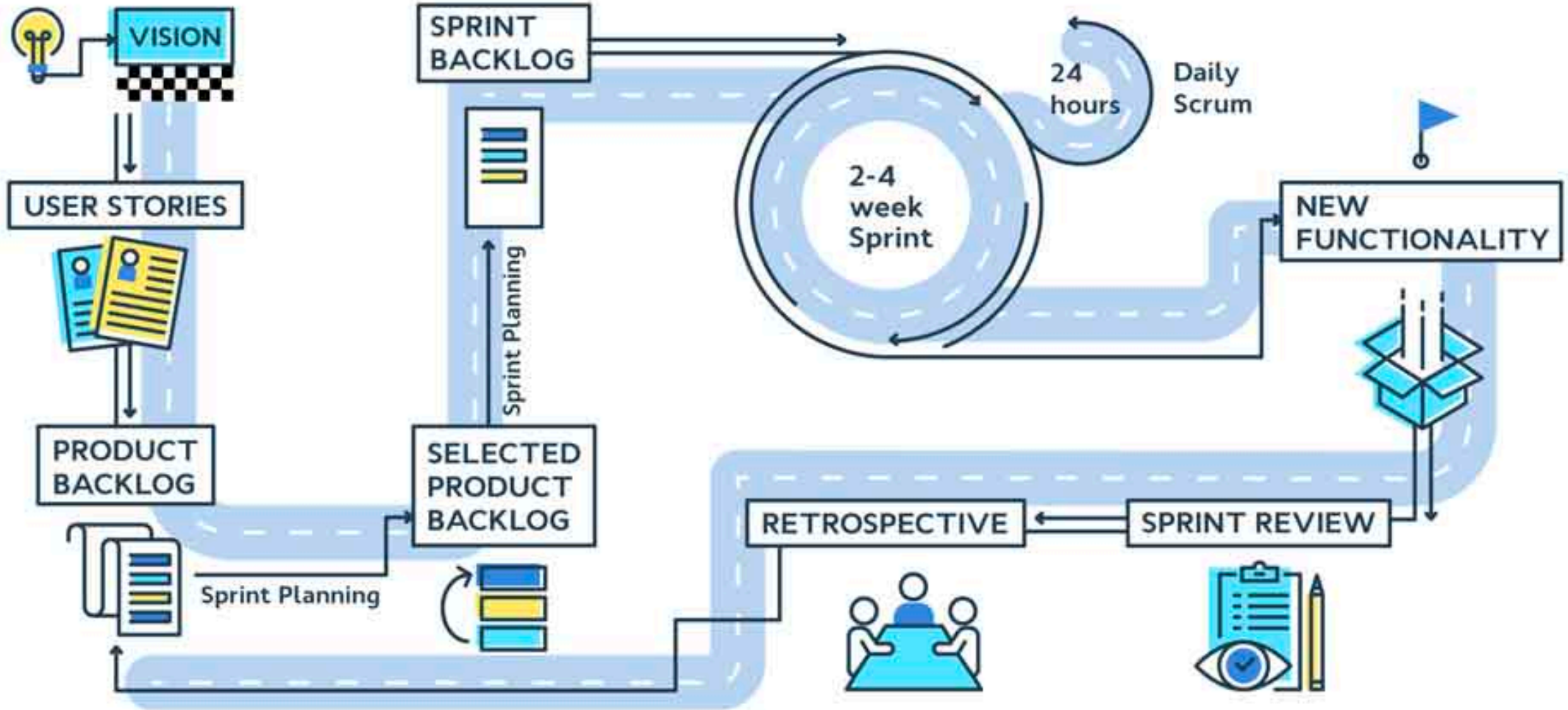
Agile Methodologies – Scrum Principles

- **Self-organization**
  - This results in healthier shared ownership among the team members.
  - It is also an innovative and creative environment which is conducive to growth.
- **Collaboration**
  - Essential principle which focuses collaborative work
- **Time-boxing**
  - Defines how time is a limiting constraint in Scrum method
  - Daily Sprint planning and Review Meetings
- **Iterative Development**
  - Emphasizes how to manage changes better and build products which satisfy customer needs
  - Defines the organization's responsibilities regarding iterative development

Agile Methodologies – Scrum



SCRUM PROCESS



Scrum tools

- Jira – https://www.atlassian.com/software/jira/
- Clarizen – https://www.clarizen.com/
- GitScrum – https://site.gitscrum.com/
- Vivify Scrum – https://www.vivifyscrum.com/
- Yodiz – https://www.yodiz.com/
- ScrumDo – https://www.scrumdo.com/
- Quickscrum – https://www.quickscrum.com/
- Manuscript – https://www.manuscript.com/
- Scrumwise – https://www.scrumwise.com/
- Axosoft – https://www.axosoft.com/

Agile vs traditional models

No	Agile Methodologies	Traditional Methodologies
1	Incremental value and risk management	Phased approach with an attempt to know everything at the start
2	Embracing change	Change prevention
3	Deliver early, fail early	Deliver at the end, fail at the end
4	Transparency	Detailed planning, stagnant control
5	Inspect and adapt	Meta solutions, tightly controlled procedures and final answers
6	Self managed	Command and control
7	Continual learning	Learning is secondary to the pressure of delivery

Agile - Advantages

- Very realistic approach to software development
- Promotes teamwork and cross training
- Functionality can be developed rapidly and demonstrated
- Resource requirements are minimum
- Suitable for fixed or changing requirements
- Delivers early partial working solutions
- Good model for environments that change steadily
- Minimal rules, documentation easily employed
- Enables concurrent development and delivery within an overall planned context
- Little or no planning required
- Easy to manage
- Gives flexibility to developers

Agile - Disadvantages

- Not suitable for handling complex dependencies.
- More risk of sustainability, maintainability and extensibility.
- An overall plan, an agile leader and agile PM practice is a must without which it will not work.
- Strict delivery management dictates the scope, functionality to be delivered, and adjustments to meet the deadlines.
- Depends heavily on customer interaction, so if customer is not clear, team can be driven in the wrong direction.
- There is a very high individual dependency, since there is minimum documentation generated.
- Transfer of technology to new team members may be quite challenging due to lack of documentation.