

## **Introduction of Software Engineering**

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# What is software?

- Computer software, or simply software, is a collection of data or computer instructions that tell the computer how to work. This is in contrast to physical hardware, from which the system is built and actually performs the work. In computer science and software engineering, computer software is all information processed by computer systems, programs and data. Computer software includes computer programs, libraries and related non-executable data, such as online documentation or digital media. Computer hardware and software require each other and neither can be realistically used on its own.

# Where is software?



# Where is software?



# Some popular software



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# Some popular software

The Google logo is displayed in its characteristic multi-colored font (blue, red, yellow, green, red).

搜尋 Google 或輸入網址



Google 學術搜尋



Google 地圖



My Drive - Goo...



IMDb - Movies,...



新增捷徑

# Some popular software

The image shows a screenshot of the Weibo (WeChat) homepage. At the top, there is a search bar with the text "大家正在搜：两颗地球静止轨道卫星成功发射" and a search icon. To the right of the search bar are navigation links for "首页" (Home), "视频" (Video), "发现" (Discover), "游戏" (Games), "注册" (Register), and "登录" (Login).

On the left side, there is a vertical menu with categories: "热门" (Popular), "头条" (Headlines), "视频" (Video), "新鲜事" (Fresh News), "榜单" (Rankings), "搞笑" (Funny), "社会" (Society), "时尚" (Fashion), "电影" (Movies), "美女" (Beautiful Women), "体育" (Sports), and "动漫" (Anime).

The main content area features a large video player with the title "头条君今日又有大发现 | 重庆万州公交车坠江前视频公布" (Headline: Today we have another big discovery | Video released before the Chongqing Wanzhou bus fell into the river). Below the video, there are several smaller images and a text post by user "周艳霞Pasha" dated "11月1日 17:40". The post includes a video player and a text description: "#头条快讯#【@重庆一公交车坠江@原因公布】重庆万州公交车坠江原因公布：乘客与司机激烈争执互殴致车辆失控（附车内乘客视频）" (Headline: Chongqing Wanzhou bus accident cause revealed: Passenger and driver had a heated fight and fought each other, causing the vehicle to lose control (with video from inside the car)).

On the right side, there is a login panel with the title "帐号登录" (Account Login) and "安全登录" (Secure Login). It includes input fields for "邮箱/会员帐号/手机号" (Email/Member Account/Phone Number) and "请输入密码" (Please enter password). There are checkboxes for "记住我" (Remember me) and "忘记密码" (Forgot password). A "登录" (Login) button is prominently displayed. Below the login fields, there is a link "还没有微博? 立即注册" (No Weibo yet? Register now) and "其它登录" (Other login) options.

Below the login panel, there is a section titled "微博新鲜事" (Weibo Fresh News) with several featured items, each with a thumbnail image and a timestamp: "实用出租车改造精选" (Today 15:49), "全球最美世界的邀请函" (17分前), "火亚伦最新动态追踪" (Today 14:12), "《英雄联盟》最新资讯" (November 1st 19:05), and "LOL职业选手新动态" (Today 13:22). A "查看更多" (View more) link is at the bottom of this section.

# Some popular software

**facebook**

Email or Phone  Password  [Log In](#)

[Forgotten account?](#)

**Facebook helps you connect and share with the people in your life.**



## Create an account

It's free and always will be.

First name  Surname

Mobile number or email address

New password

**Birthday**

2 ▾ Nov ▾ 1993 ▾ Why do I need to provide my date of birth?

Female  Male

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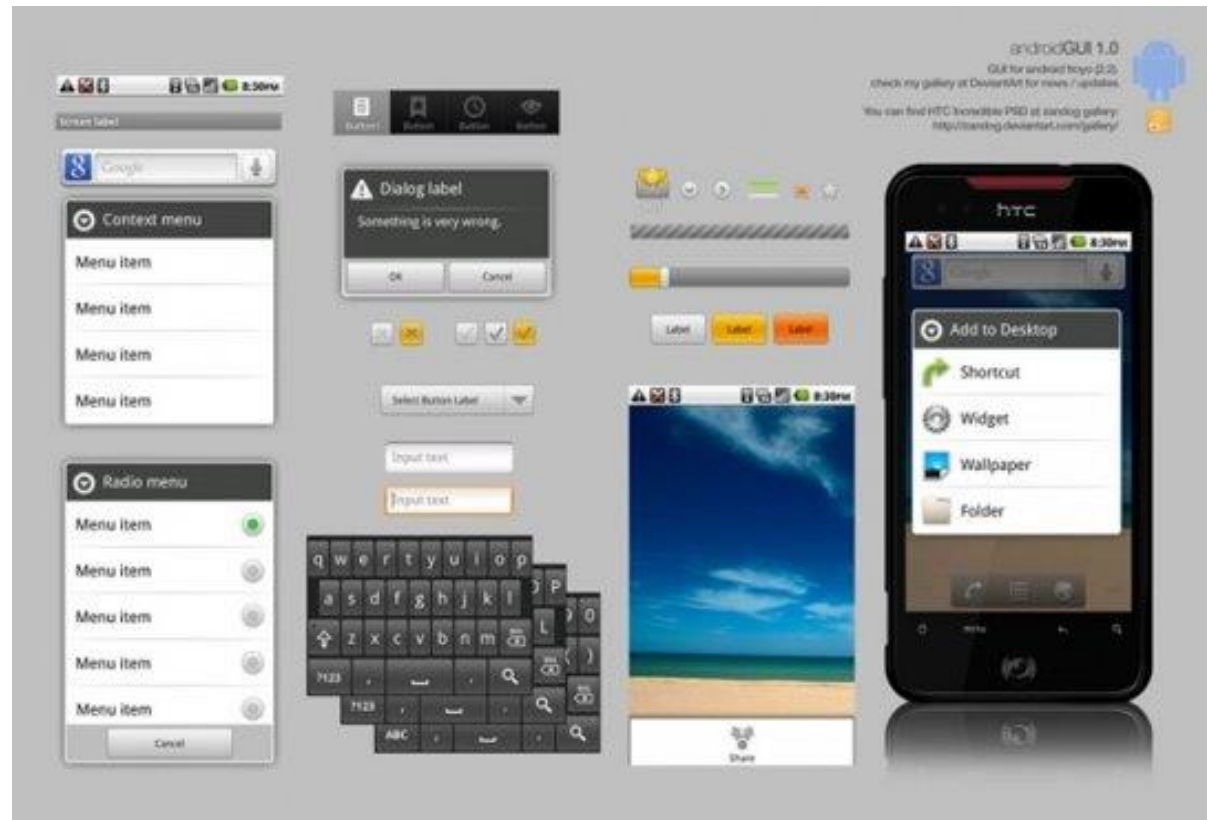




# Some popular software

The image shows a YouTube video player interface. The main video is a basketball game between the Minnesota Timberwolves and the Utah Jazz. The score is Jazz 3, Timberwolves 0, 1st Qtr, 10:23. The video title is "Derrick Rose Career-High 50 points Highlights" and it has 123,635 views. The right sidebar shows several recommended videos, including "Derrick Rose's UNREAL Top 30 Plays!", "10 Greatest Signature Moves in NBA History!", and "De'Aaron Fox Triple-Double 2018, 11.01 Kings vs Hawks...".

# Even on mobile devices



# Importance of Software

- Software is everywhere!
- The economies of all developed nations are dependent on software
- Software costs often dominate system costs
- Software costs more to maintain than to develop!

A vertical bar on the left side of the slide, transitioning from dark red at the top to orange at the bottom.

# Software Engineering

# Definitions: Software Engineering

- Engineering:
  - Action of defining and sequencing necessary tasks for the creation of a new product or service
- Software Engineering:
  - Engineering discipline concerned with all aspects of software production
  - Captures the customers' business needs and specify the blueprints for the system, so that programmers can implement it

# Definitions: Software Engineering

Software Engineering is the application of a **systematic, disciplined, quantifiable** approach to the development, operation and maintenance of software

# Definitions: Software Engineering

- Software Engineers must:
  - Adopt a systematic and organized approach to their work
  - Use appropriate tools and techniques

... depending on:

- The problem to be solved
- The development constraints
- The available resources

... with a given **budget**

... before a given **deadline**

... while **changes** occur!



# What's the problem?

Some problems encountered during software development:

- The software does not suit the users' needs.
- Difficult to expand after deployment.
- Poor documentation.
- Poor quality.
- Process of development costs more money and time than expected.

# A good software ...

- delivers the required **functionality** and **performance** to the user
- is **maintainable** : evolves to meet changing needs
- is **dependable** : must be trustworthy and secure
- is **usable** by its users
- is **efficient** : should not make wasteful use of system resources
- is **reusable**: can be reused in another form or for other purposes

# Skills of a Software Engineer

- A software engineer is not (only) a developer!
  - “ It is not enough to do your best: you must **KNOW what to do, THEN do your best**”

W. Edwards Deming

- Aside from the technical skills, a software engineer must have other skills :
  - ✓ Communication
  - ✓ Feedback
  - ✓ Motivation
  - ✓ Analytical
  - ✓ Planning
  - ✓ Risk assessment

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# SDLC: Software Development Lifecycle

# SDLC: Definition and Actors

- **SDLC:** Process of creating and altering systems, and the models and methodologies that people use to develop these system
- **Actors:** Mainly (but not only)

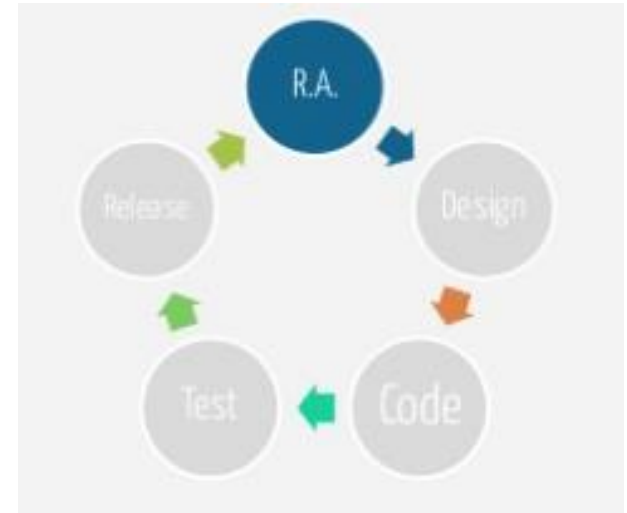


# SDLC: Steps



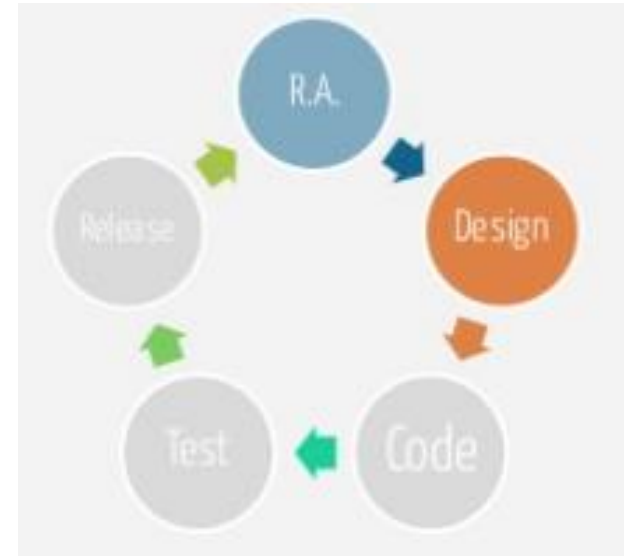
# Step 1: Requirement Analysis

- Work closely with the customer
  - Customer can be
    - A client
    - Your employer
    - Or yourself
- Focus on the “What”, not the “How”
- End Result: **Functional Specification**
- Reviewed by :
  - Customer, Designer.



# Step 2: Design

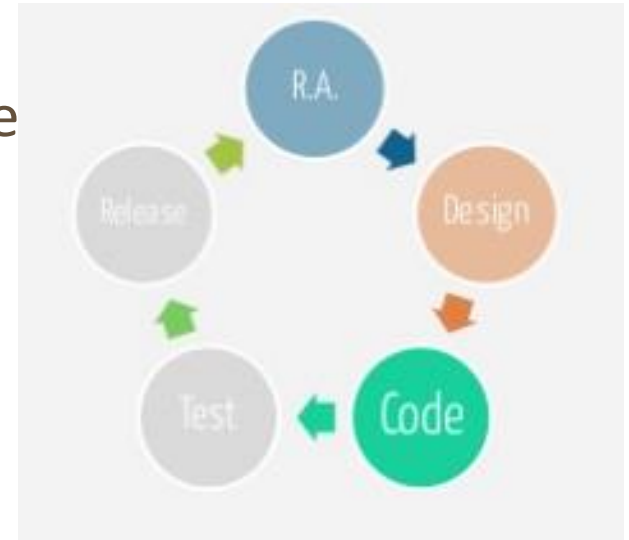
- Focus on the “How”
- Break the problem into smaller pieces
  - Components
- End Result: **Design Specification**
- Reviewed by :
  - Designer, Developer





# Step 3: Implementation

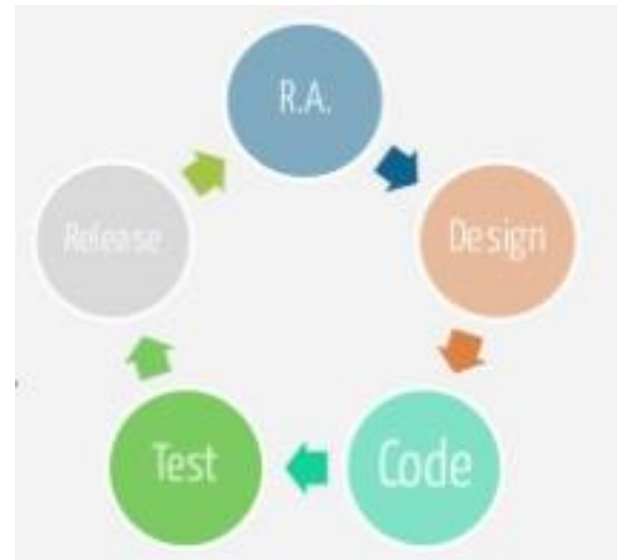
- Write the code according to design
- In some cases(oddly) the shortest phase
- End Result: **Executable\* Application**
- Reviewed by :
  - Designer, Developer, Tester.



\* or not ...

# Step 4: Testing

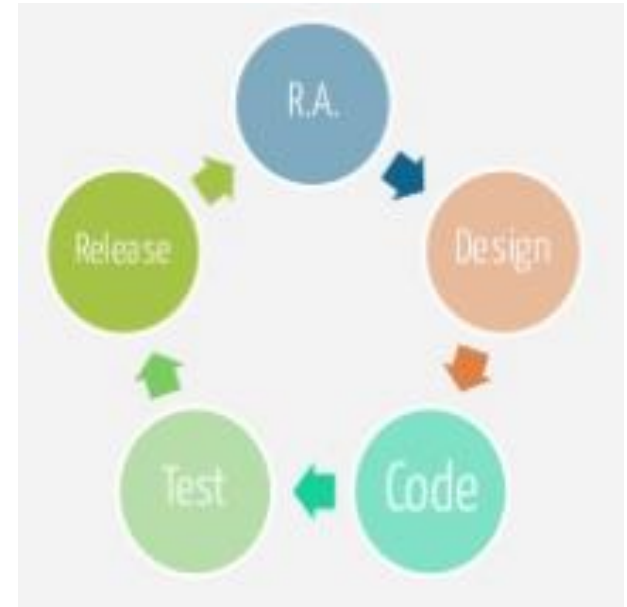
- Verify the code works according to the functional specification
- Look for corner cases
- End Result: **Test Plan**,  
A program that **works\***
- Reviewed by :
  - Designer, Developer, Tester.



\* hopefully ...

# Step 5: Release

- Close to the customers(again)
- Validate their expectations
- Get feedback for
  - Next version
  - Maintenance
- End Result: A **happy** customer  
and lots of \$\$\$



# Development Disasters

## Product development from an IT failures perspective



# Disasters related to Designers



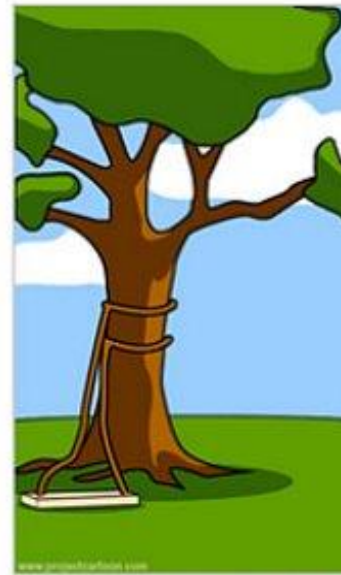
How the customer explained it



How the project leader understood it



How the analyst designed it



How the programmer wrote it



What the customer really needed

# How can Software Engineering help?

Software engineering aims to:

- Guarantee the timeline of production, prevents missing the deadlines.
- Guarantee the quality of product, prevents the crash of a system.
- Guarantee the integrity of software, with full documentation and suits the needs of the users.

# What is a Software Process Model ?

There are many different software processes, but all involve:

- Specification – defining what the system should do;
- Design and implementation – defining the organization of the system and implementing the system;
- Validation – checking that it does what the customer wants;
- Evolution – changing the system in response to changing customer needs.

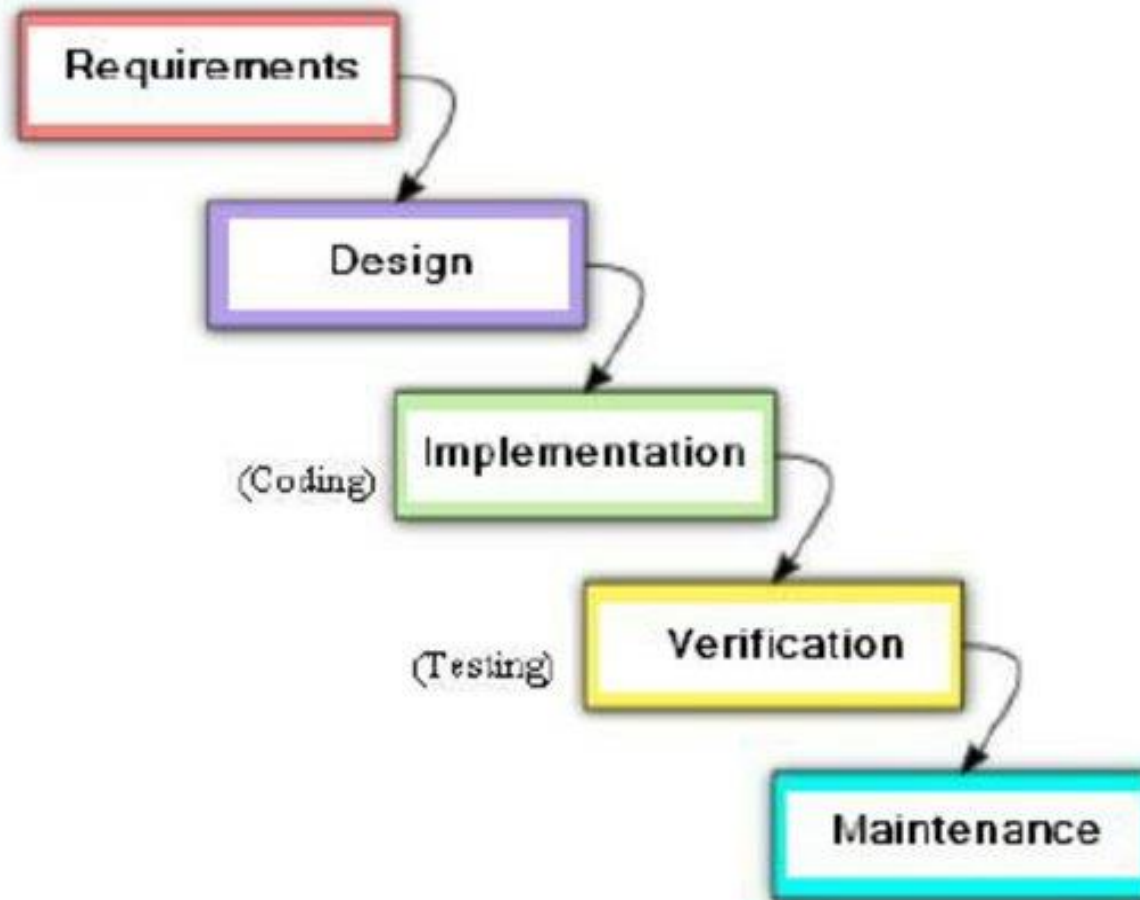
# Software Development Lifecycle Model

The most used, popular and important SDLC models:

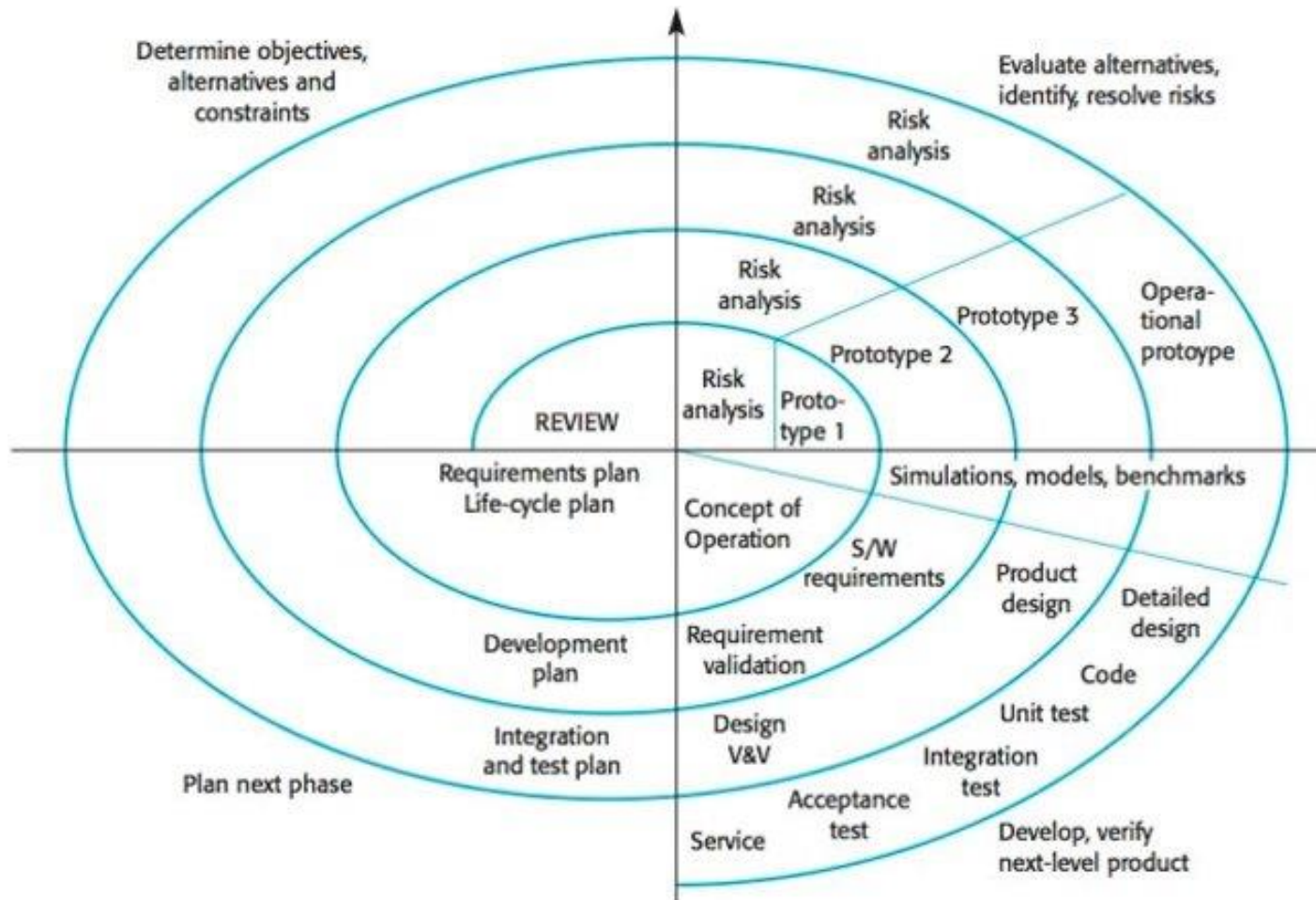
- Waterfall model
- V model
- Incremental model
- RAD model
- Agile model
- Iterative model
- Spiral model
- Prototype model



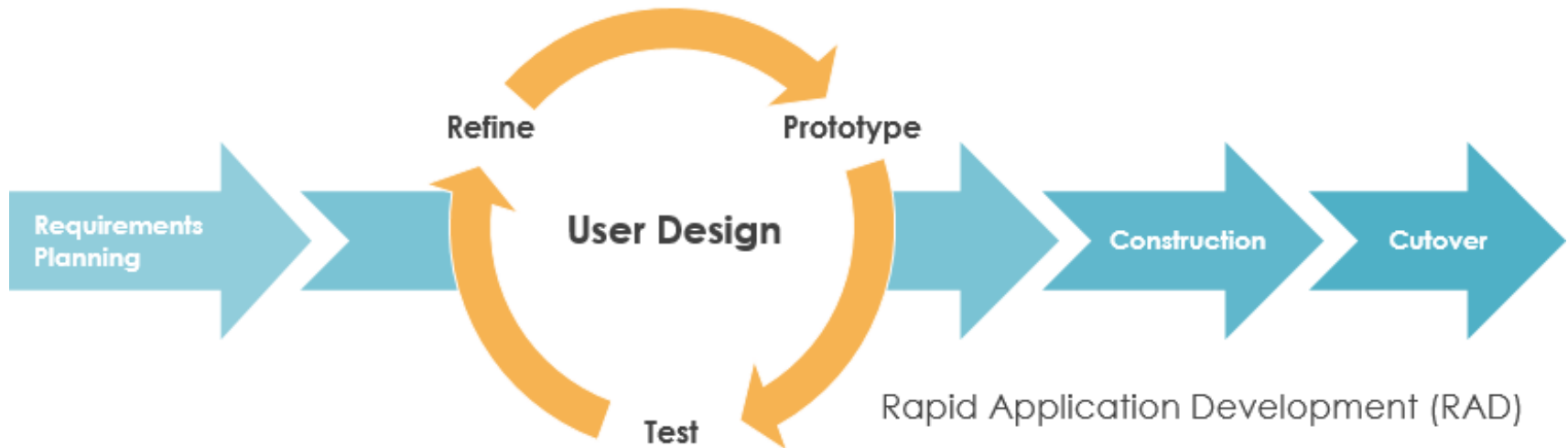
# Waterfall Model



# Spiral Model



# RAD Model





**Thank you**