47006- ANÁLISE E MODELAÇÃO DE SISTEMAS

Software Processes: systematic approaches to software development

Ilídio Oliveira | 2020-10-14

universidade de aveiro
departamento de eletrónica,
telecomunicações e informática

deti

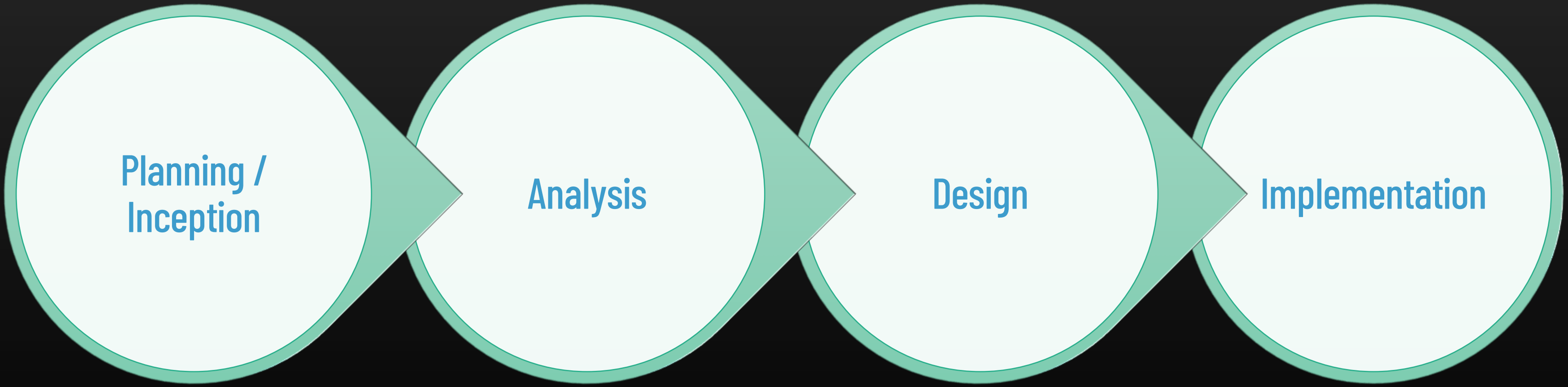
Objetivos de aprendizagem

- Identificar atividades comuns a todos os projetos (ciclo de vida)
- Distinguir projetos sequenciais de projetos evolutivos
- Descrever a estrutura do Unified Process (fases, objetivos, iterações)
- Identificar as principais atividades exigidas na atribuição do projeto
- Mapear disciplinas técnicas nas fases do OpenUP

Software Development lifecycle

Quatro fases fundamentais: planeamento/conceito, análise, desenho e implementação. Diferentes projetos podem enfatizar diferentes partes do SDLC ou realizar as fases SDLC de diferentes formas, mas todos os projetos têm elementos destas quatro fases.

Cada fase é composta por uma série de atividades, em que aplica disciplinas técnicas para produzir resultados previstos.



Fases fundamentais: planeamento, análise, desenho e implementação

A fase de planeamento é o processo fundamental de compreensão do porquê de um sistema de informação ser construído e determinar como a equipa do projeto irá construí-lo.

Atividades-chave:

1. Arranque do projeto (obter o "OK")

O valor que o sistema gerará para a organização é identificado.

O pedido do sistema e a análise de viabilidade são apresentados a uma comissão para decidir se o projeto deve ser realizado.

2. Gestão do projeto

O gestor do projeto cria um plano de trabalho, equipa o projeto, e coloca técnicas para a equipa controlar e dirigir o projeto através de todo o SDLC.

Fases fundamentais: planeamento, análise, desenho e implementação

A fase de análise responde às questões de quem irá usar o sistema, o que o sistema vai fazer, e onde e quando será utilizado.

Durante esta fase, a equipa do projeto investiga qualquer sistema atual, identifica oportunidades de melhoria e desenvolve um conceito para o novo sistema.

Atividades-chave:

1. Análise dos sistemas existentes,
2. Recolha de requisitos (necessidades da organização)
3. Conceito de solução (proposta do sistema)

Fases fundamentais: planeamento, análise, desenho e implementação

A fase de desenho (=projeto técnico) decide como o sistema funcionará, em termos de hardware, software e infraestrutura de rede; a interface, formulários e relatórios do utilizador; e os programas específicos, bases de dados e ficheiros que serão necessários.

Atividades-chave:

1. Estratégia de desenvolvimento (interna ou contratar?)
2. Desenho da arquitetura do sistema
3. Desenho do modelo de dados
4. Desenho dos programas (classes, etc.)

Fases fundamentais: planeamento, análise, desenho e implementação

Na fase de implementação, o sistema é efetivamente construído (ou adquirido, no caso de integração de pacotes existentes).

Inclui também a transição para o ambiente de produção.

Atividades-chave:

1. Implementação de sistemas (construção e garantia de qualidade)
2. Instalação e transição
3. Plano de suporte (revisão pós-instalação e gestão de alterações)

Towards an engineering process

The SDLC is realized using a systematic software process.

Why do we need a formal process?

Failures occur (too) often

Creating systems is not intuitive.

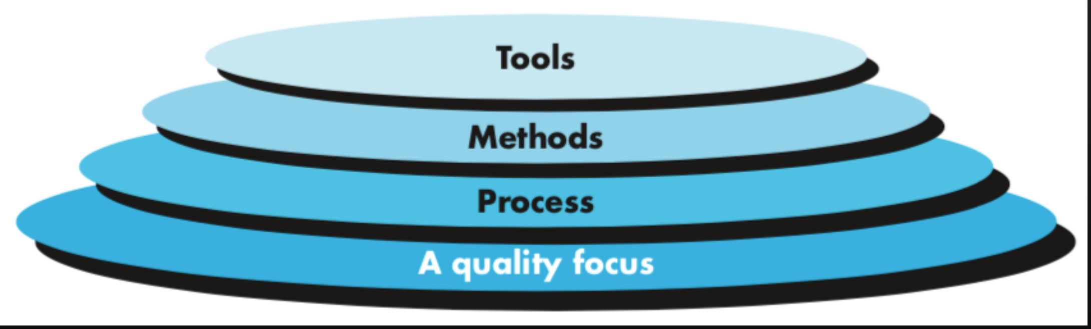
Projects are late, over budget or delivered with fewer features than planned

Credit: Dennis et al, “*Systems Analysis and Design: An Object Oriented Approach with UML*”, 5th ed.

Software Process

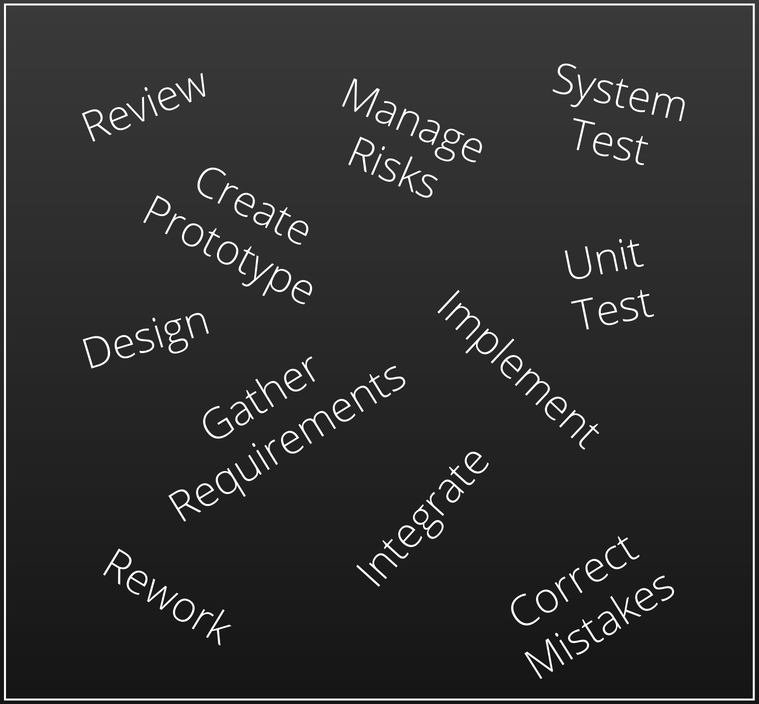
A software process is a framework for the activities, actions, and tasks that are required to build high-quality software.

It establishes the technical and management framework for applying methods, tools, and people to the development task.

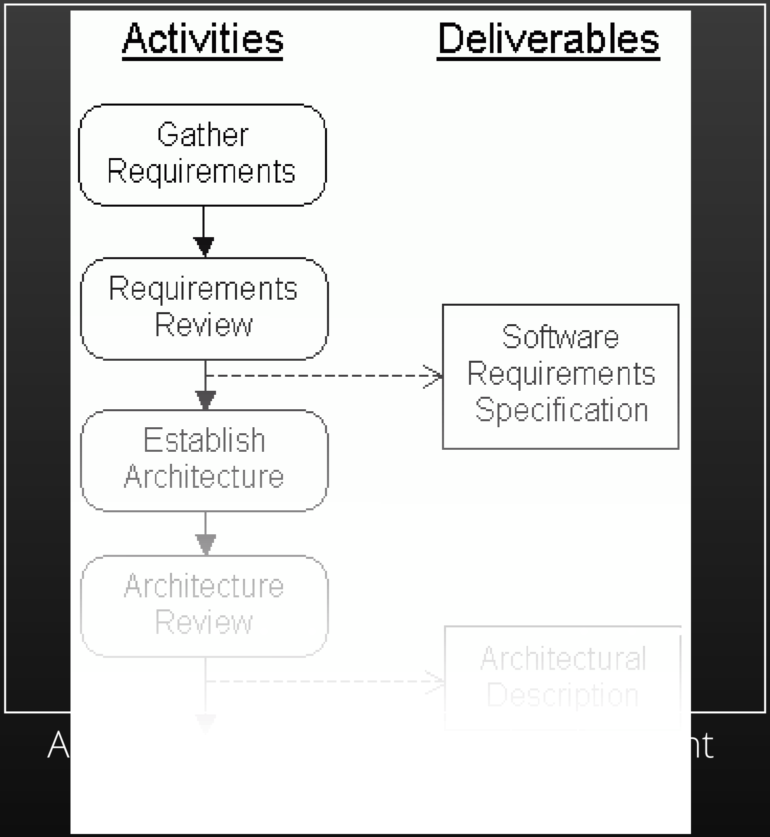


Is "process" synonymous with "software engineering"? Yes and no. A software process defines the approach that is taken as software is engineered.
But software engineering also encompasses technologies that populate the process—technical methods and automated tools.

Why Software Process?



Developing software without a defined process is chaotic and inefficient



A

nt

"It is better not to proceed at all, than to proceed without method." -- Descartes

Software process description

When we describe and discuss processes, we usually talk about …

the activities in these processes such as specifying a data model, designing a user interface, etc. and the sequence of these activities (process flow).

Process descriptions may also include:

Products, which are the outcomes of a process activity;

Roles, which reflect the responsibilities of the people involved in the process;

Pre- and post-conditions (dependencies), which are statements that are true before and after a process activity has been enacted or a product produced.

Software process

A process specifies:

What?

Who?

How?

When?

A process includes:

Roles

Workflows

Procedures

Standards

Templates

There is no single “best process”

Organizations should select (or customize) their process.

http://sweet.ua.pt/ico/OpenUp/OpenUP_v1514/

Plan-driven or evolutionary processes?

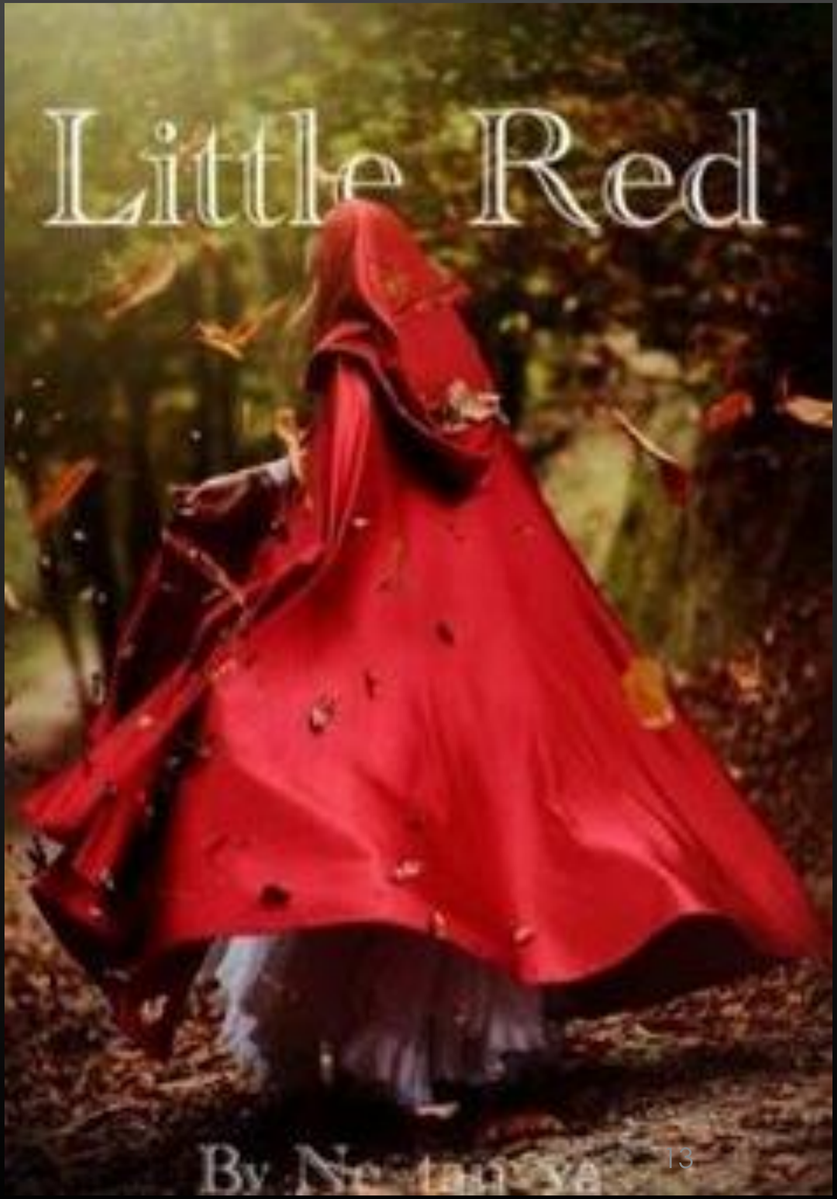
Plan-driven/prescriptive processes

all of the process activities are planned in advance and progress is measured against this plan.

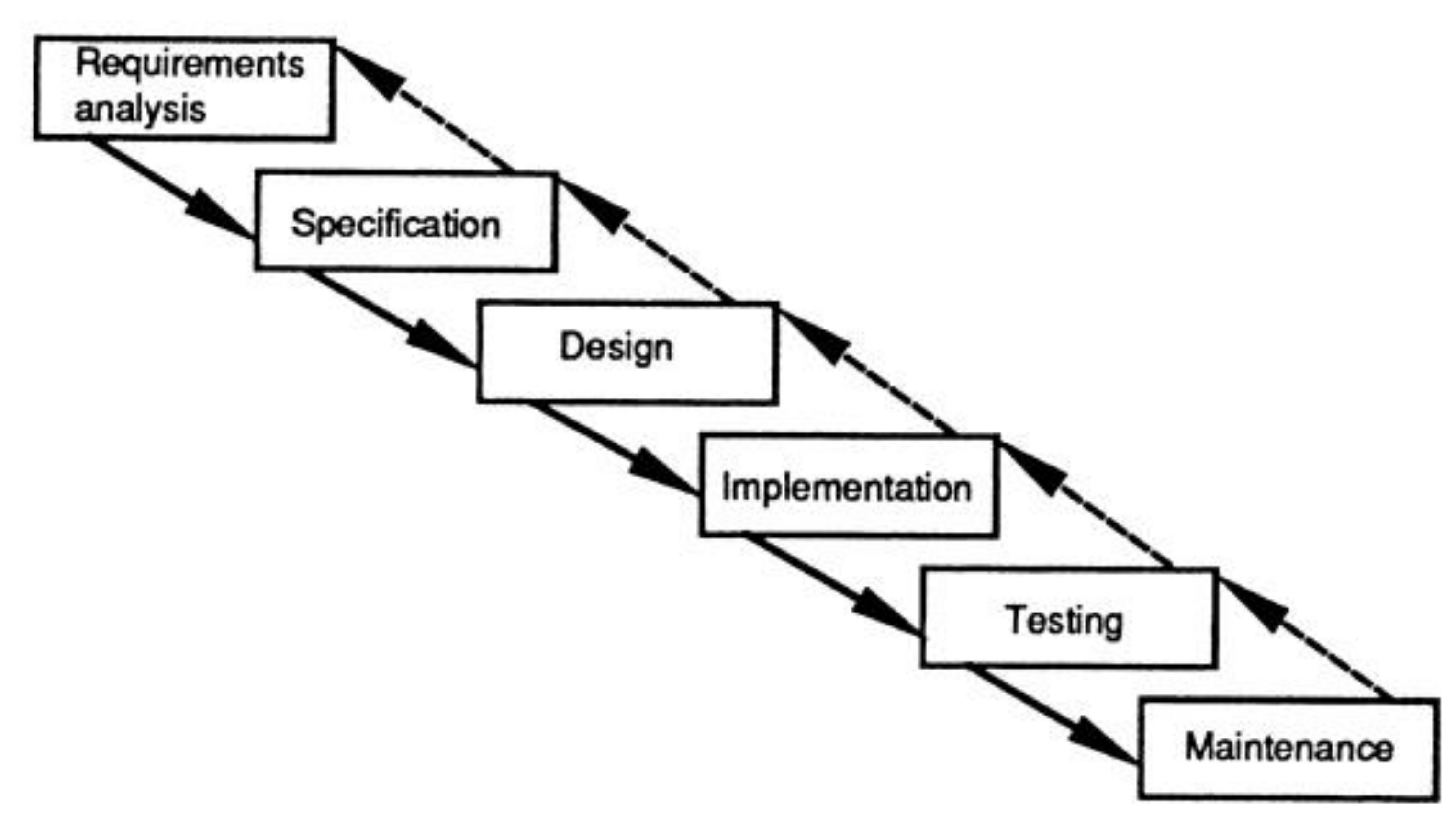
Evolutionary processes

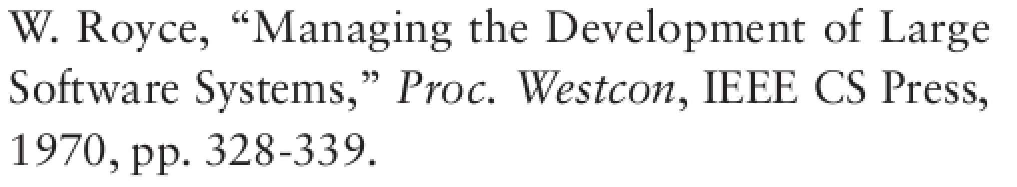
planning is incremental and it is easier to adapt to changing customer requirements.

http://zle.9n.xsl.pt



"Classical" engineering approach: Waterfall model




W. Royce, "Managing the Development of Large Software Systems," *Proc. Westcon*, IEEE CS Press, 1970, pp. 328-339.

Waterfall model advantages

Simple and easy to understand and use.

Easy to plan

A schedule can be set with deadlines for each stage of development and a product can proceed through the development process like a car in a car-wash, and theoretically, be delivered on time.

Easy to manage

each phase has specific deliverables and a review process.

Phases are processed and completed one at a time.

Works well where requirements are stable and well understood

Waterfall model disadvantages

Problems

Difficulty of accommodating change after the process is underway.

Poor model for long and ongoing projects.

No working software is produced until late during the life cycle.

Not suitable for the projects where requirements are uncertain or at the risk of changing.

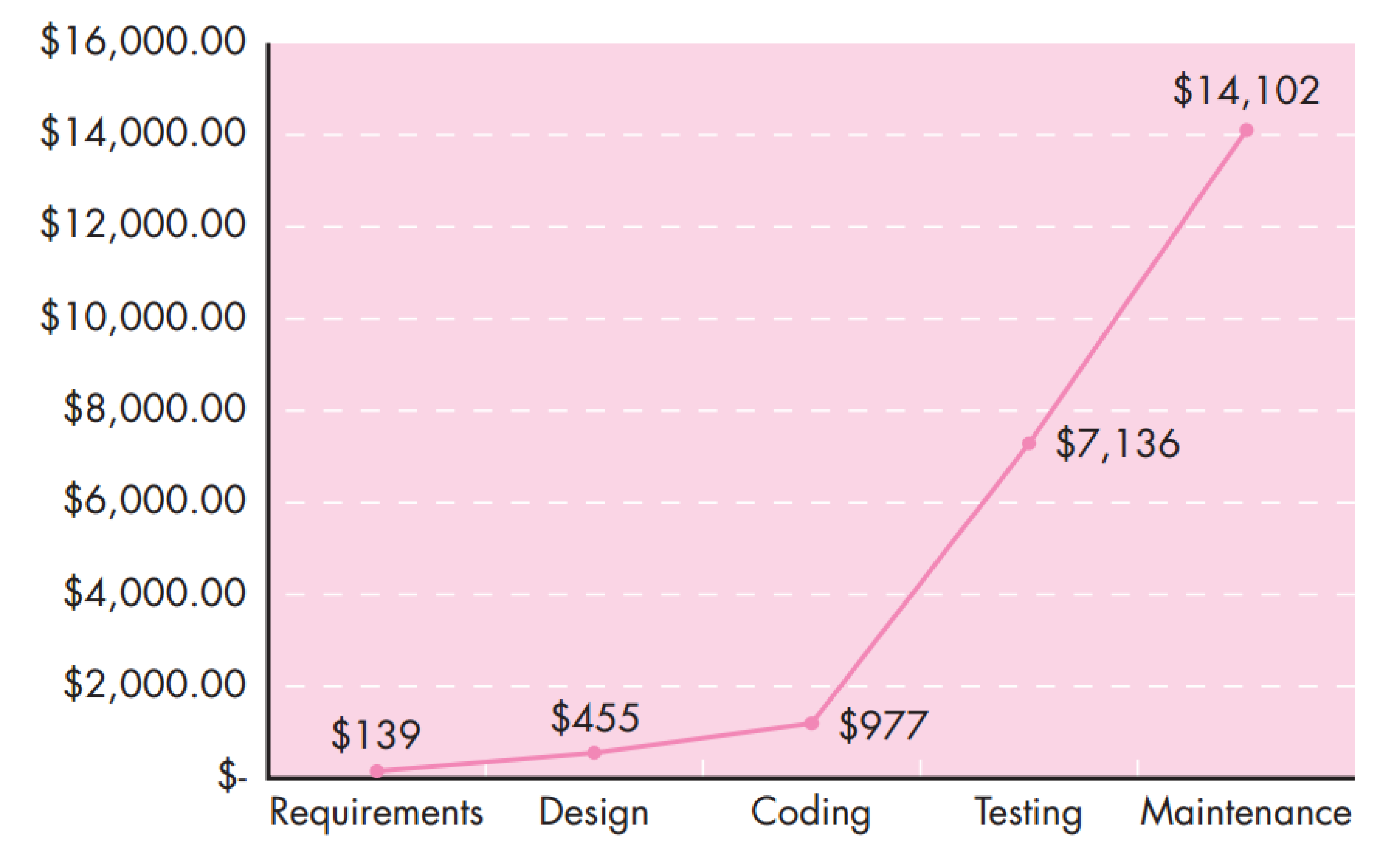
Why it may fail?

Real projects rarely follow the sequential flow that the model proposes

It is often difficult for the customer to state all requirements explicitly

The customer must have patience. A working version of the program(s) will not be available until late in the project time span

The cost of correcting an error raises exponentially along the sw lifecycle

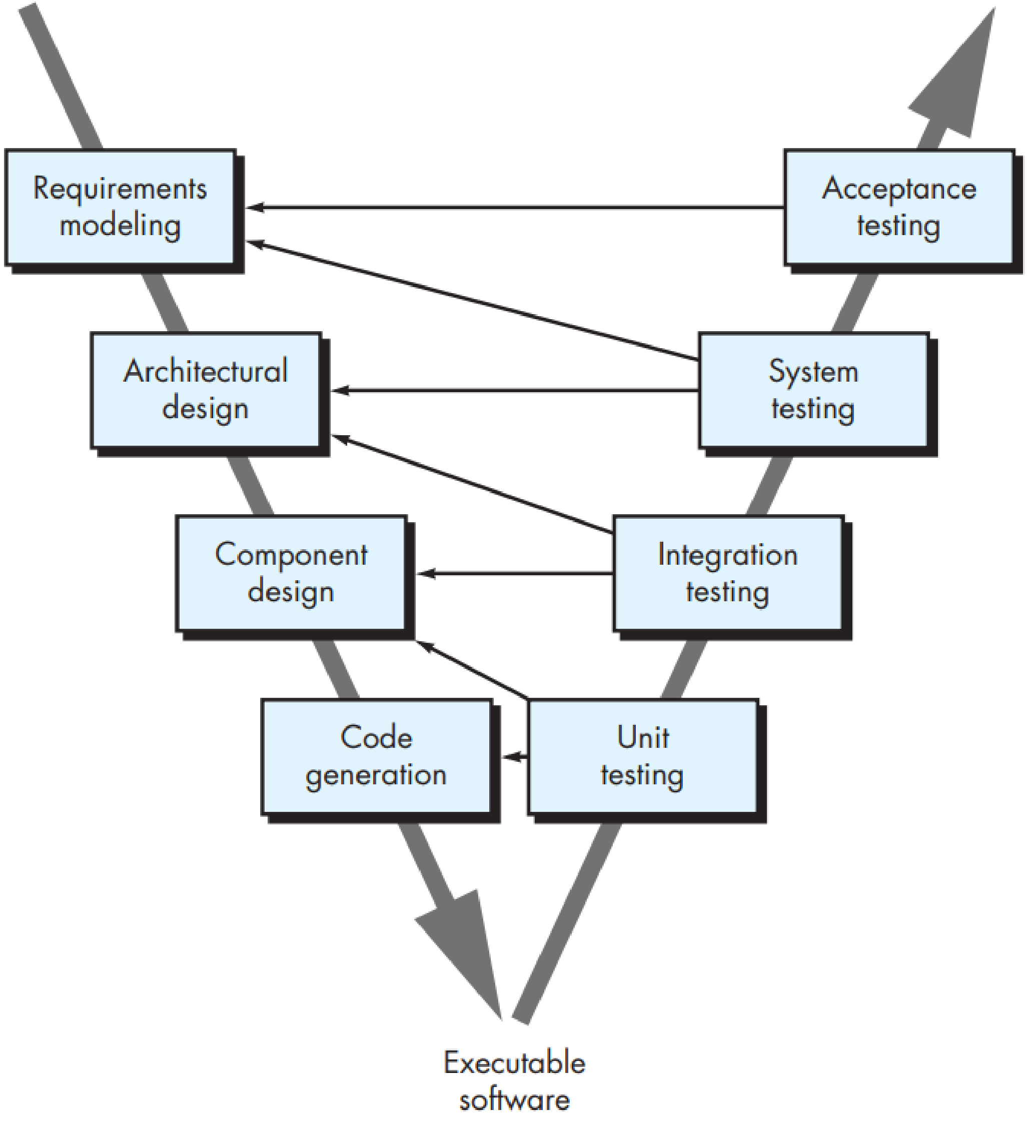


Boehm, B., and V. Basili, “Software Defect Reduction Top 10 List,” IEEE Computer, vol. 34, no. 1, January 2001, pp. 135–137. http://doi.ieeecomputersociety.org/10.1109/2.962984

Waterfall variation: V-Model

FIGURE 4.2

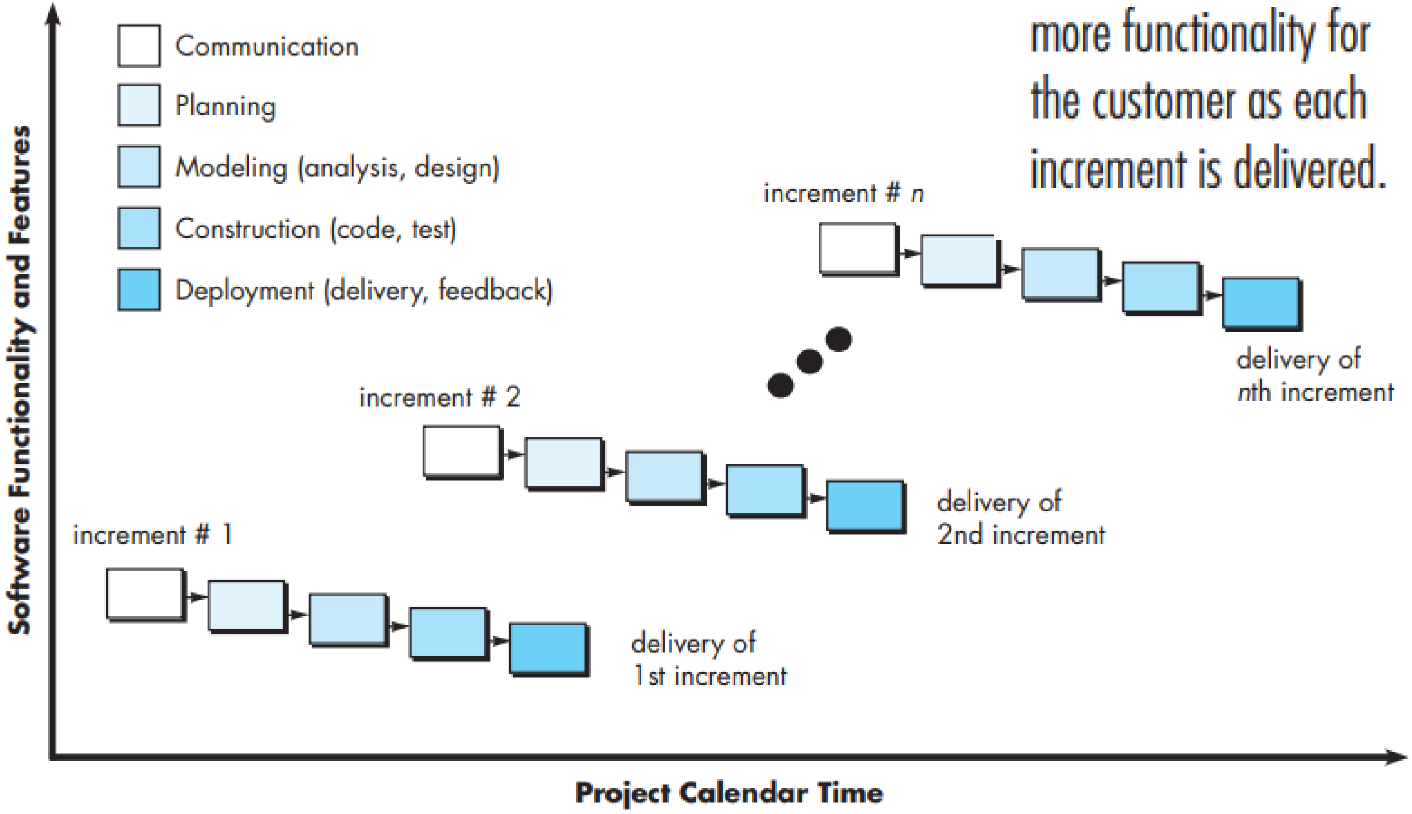
The V-model



The incremental model delivers a series of releases, called increments, that provide progressively more functionality for the customer as each increment is delivered.

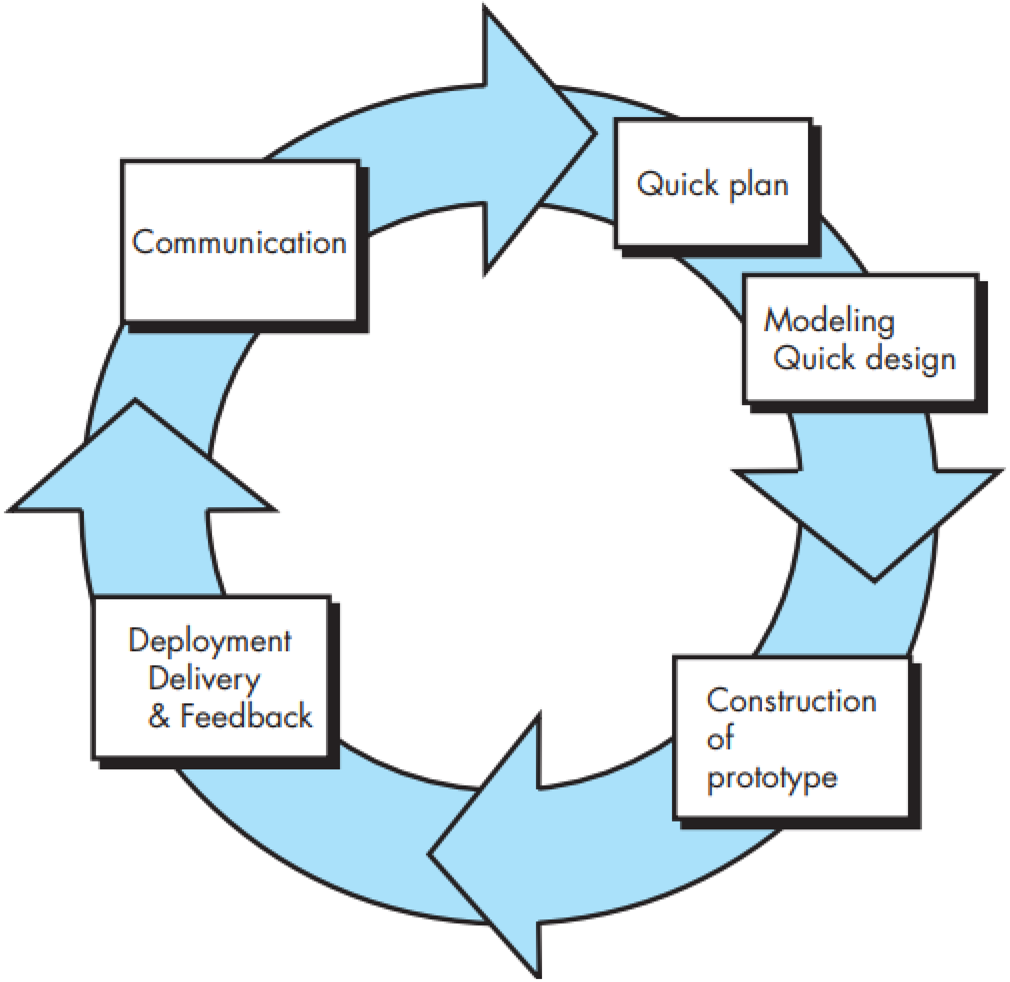
Figure 4.3

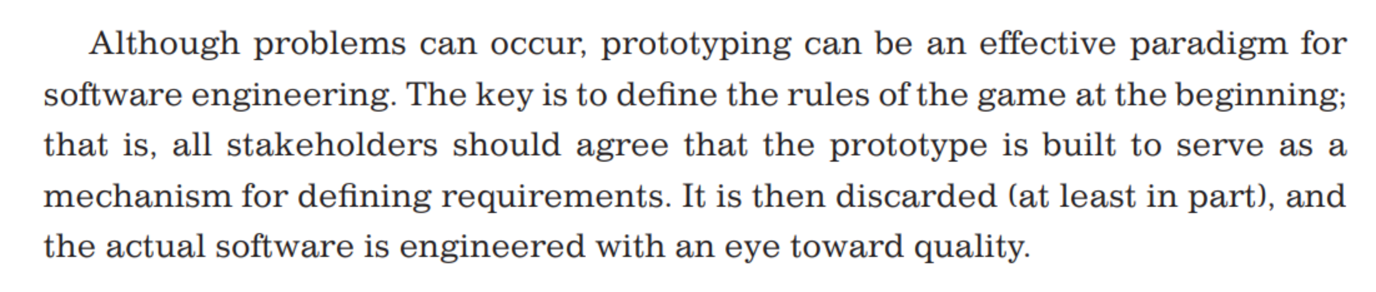
The incremental model



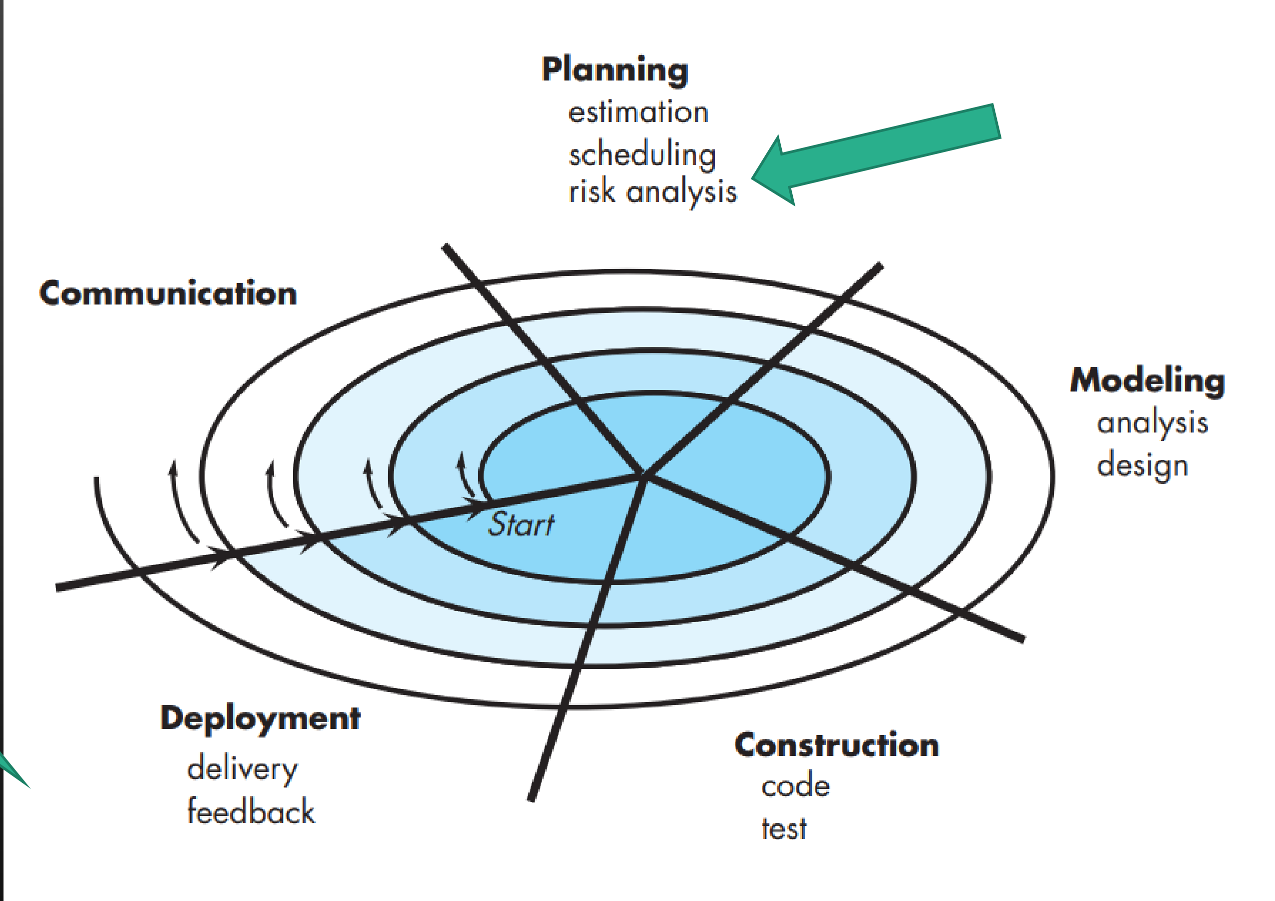
Communication
Planning
Modeling (analysis, design)
Construction (code, test)
Deployment (delivery, feedback)
increment # 1
delivery of 1st increment
increment # 2
delivery of 2nd increment
increment # *n*
delivery of *n*th increment
Software Functionality and Features
Project Calendar Time

Evolutionary: protyping

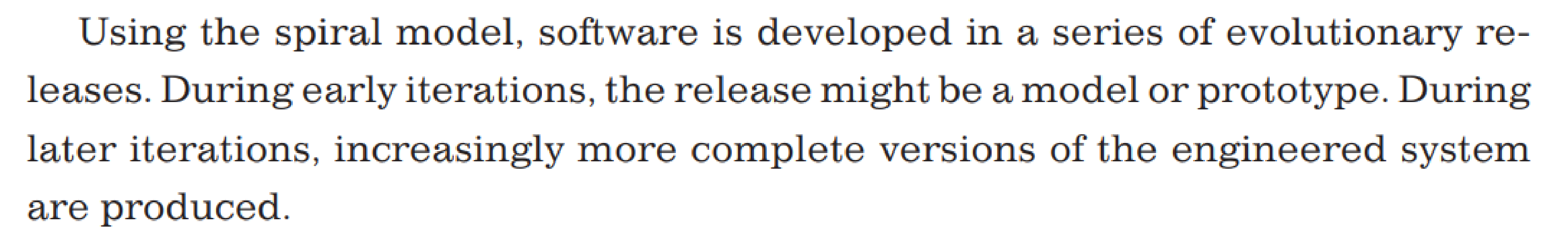



Although problems can occur, prototyping can be an effective paradigm for software engineering. The key is to define the rules of the game at the beginning; that is, all stakeholders should agree that the prototype is built to serve as a mechanism for defining requirements. It is then discarded (at least in part), and the actual software is engineered with an eye toward quality.

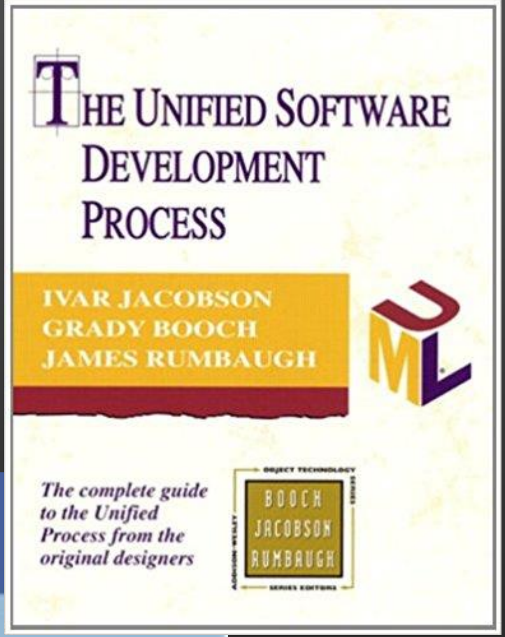
Evolutionary: spiral model



Deployments don't need to be working software



Using the spiral model, software is developed in a series of evolutionary releases. During early iterations, the release might be a model or prototype. During later iterations, increasingly more complete versions of the engineered system are produced.



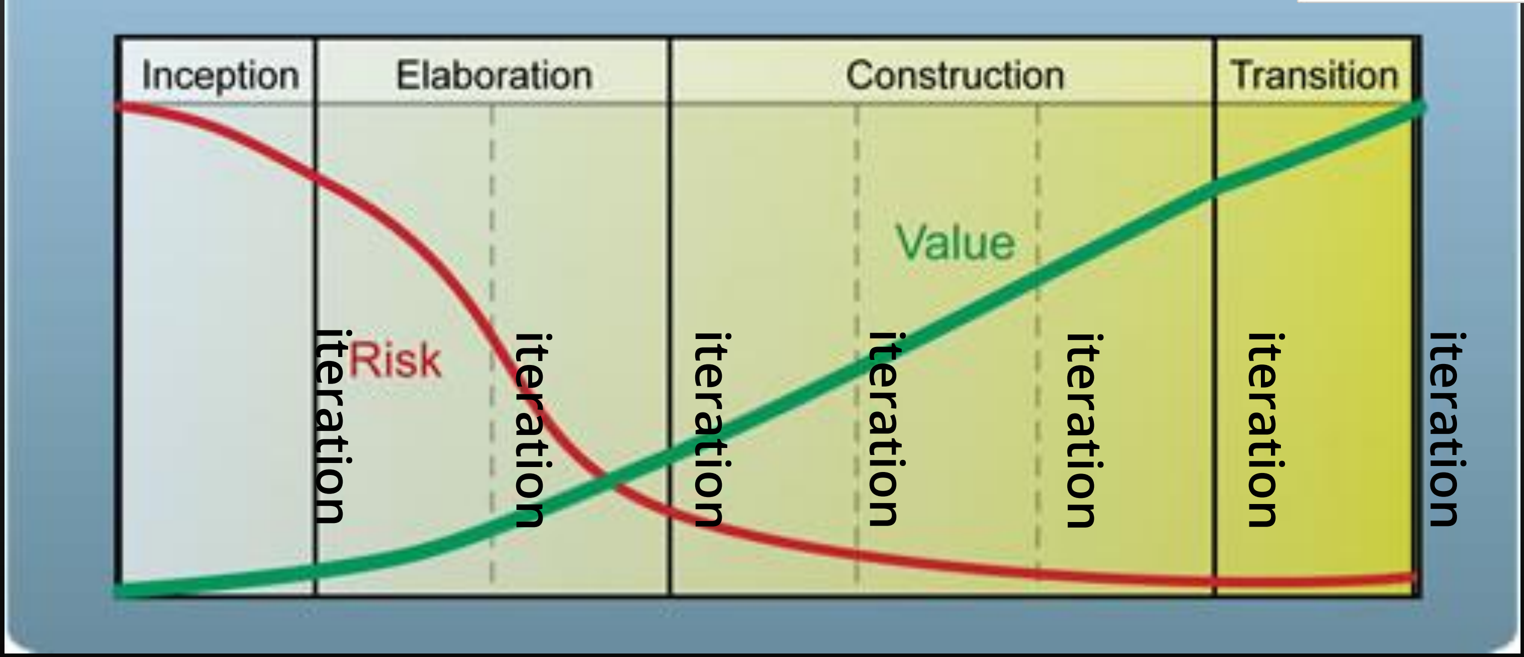
THE UNIFIED SOFTWARE DEVELOPMENT PROCESS

IVAR JACOBSON
GRADY BOOCH
JAMES RUMBAUGH

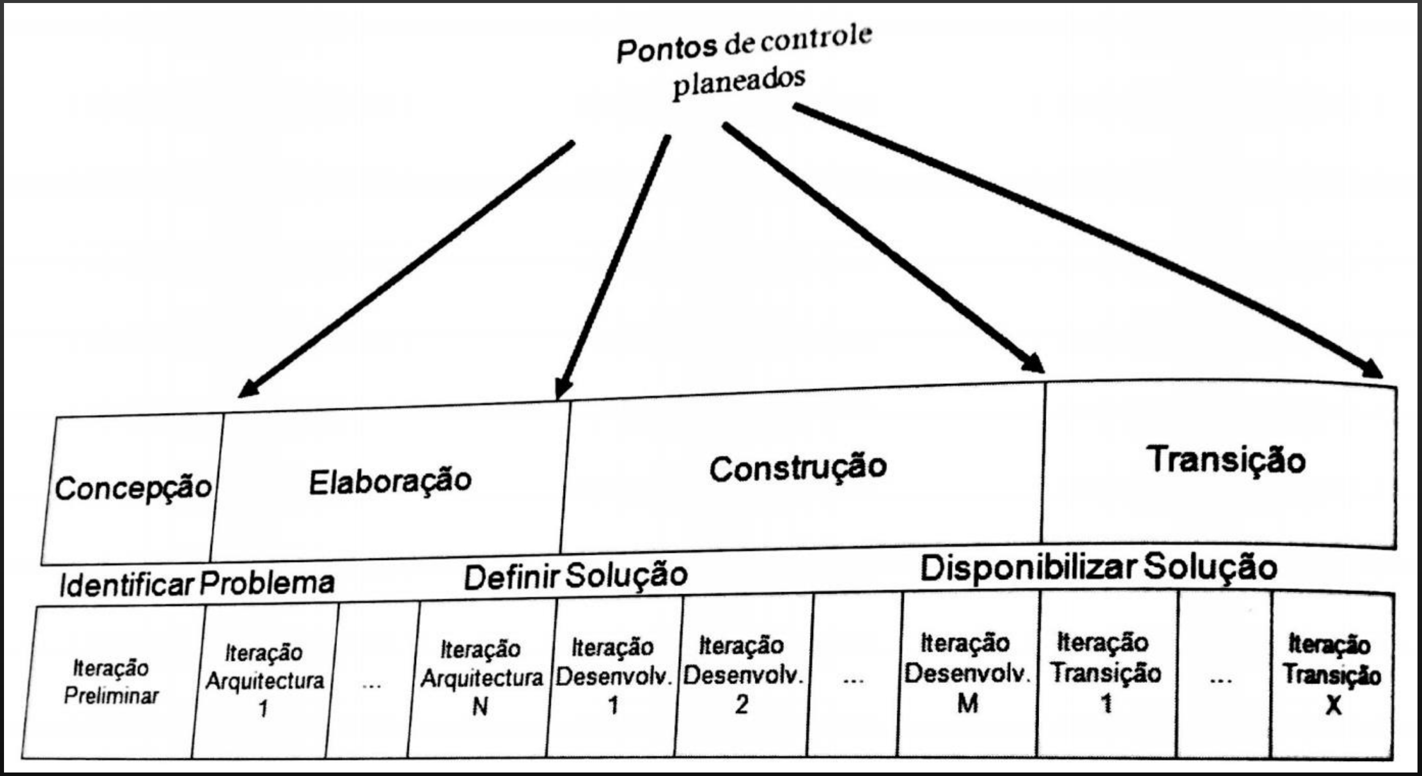
The complete guide to the Unified Process from the original designers

BOOCH JACOBSON RUMBAUGH

Project Lifecycle



PT: Fases, iterações e pontos de controlo



Pontos de controle planeados

Concepção	Elaboração	Construção	Transição

Identificar Problema

Definir Solução

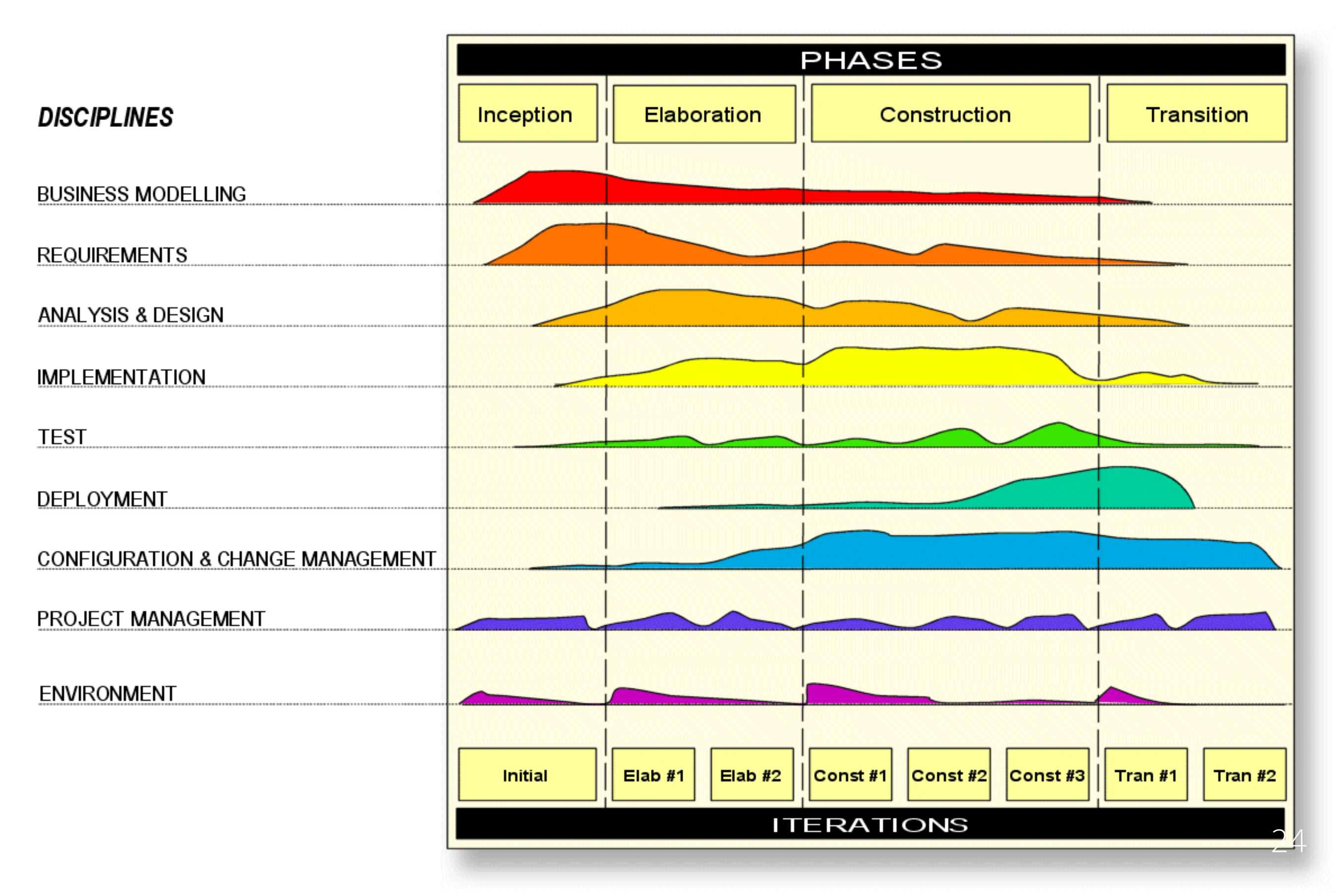
Disponibilizar Solução

Iteração Preliminar	Iteração Arquitectura 1	...	Iteração Arquitectura N	Iteração Desenvolv. 1	Iteração Desenvolv. 2	...	Iteração Desenvolv. M	Iteração Transição 1	...	Iteração Transição X

OpenUP/Unified Process activities

The UP offers an approach to the SDLC visualized as **a matrix**, crossing different **technical disciplines** with evolving **iterations** in the project. (Note: UP phases ≠ SDLC phases)

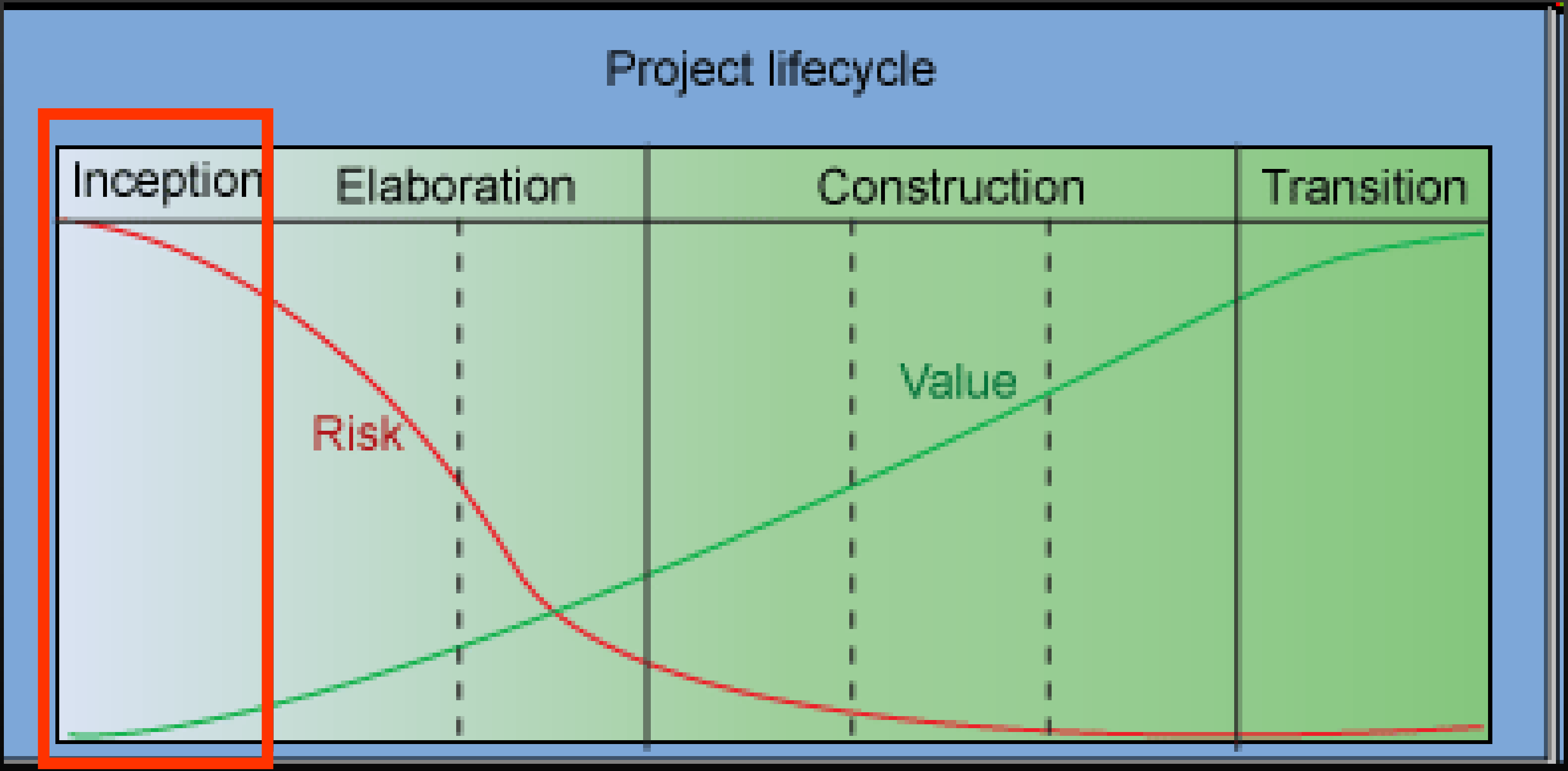
Requirements analysis is mainly performed at the beginning of the project (requirements baseline) but also during the iterations (evolutionary requirements).



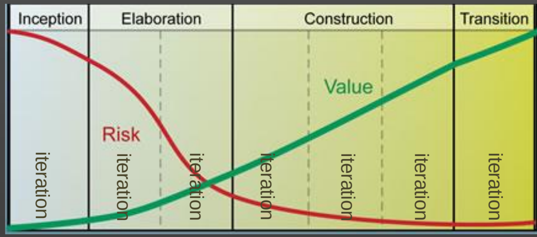
The phases: Inception

Figura Project lifecycle

Do we agree on project scope and objectives, and whether or not the project should proceed?



Inception: Know What to Build



Typically one short iteration

Produce vision document and initial business case

Develop high-level project requirements

Initial use-case and (optional) domain models (10-20% complete)

Focus on what is required to get agreement on ‘big picture’

Manage project scope

Reduce risk by identifying key requirements

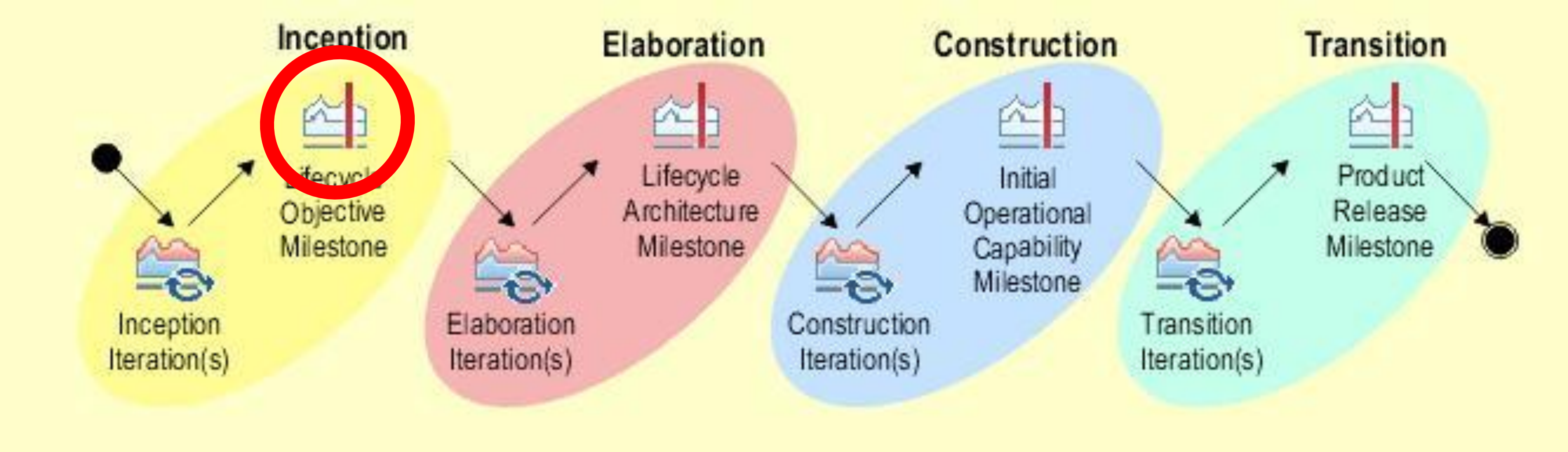
Acknowledge that requirements will change

Manage change, use iterative process

Produce conceptual prototypes as needed

Credit: Per Kroll (IBM)

Milestone: Inception


Inception
Elaboration
Construction
Transition
Lifecycle Objective Milestone
Lifecycle Architecture Milestone
Initial Operational Capability Milestone
Product Release Milestone
Inception Iteration(s)
Elaboration Iteration(s)
Construction Iteration(s)
Transition Iteration(s)

Lifecycle Objectives Milestone. At this point, you examine the cost versus benefits of the project, and decide either to proceed with the project or to cancel it.

Elaboration: Know How to Build It by Building Some

Elaboration can be a day long or several iterations

Balance

mitigating key technical and business risks with producing value (tested code)

Produce (and validate) an executable architecture

Define, implement and test interfaces of major components. Partially implement some key components.

Identify dependencies on external components and systems. Integrate shells/proxies of them.

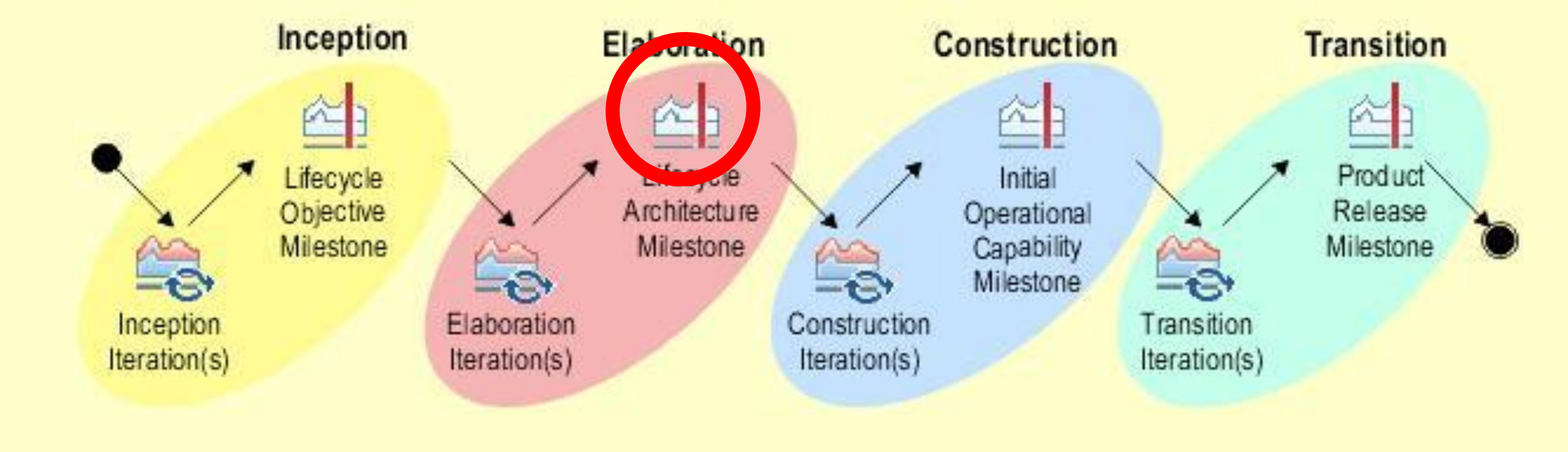
Roughly 10% of code is implemented.

Drive architecture with key use cases

20% of use cases drive 80% of the architecture

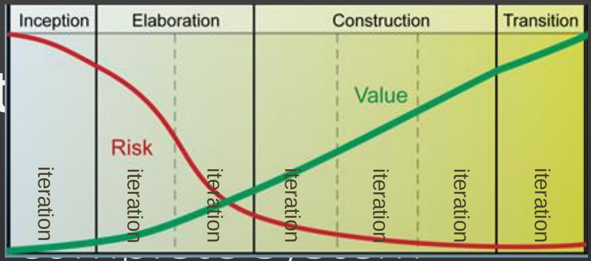
Credit: Per Kroll (IBM)

Milestones: Elaboration


Inception
Elaboration
Construction
Transition
Lifecycle Objective Milestone
Lifecycle Architecture Milestone
Initial Operational Capability Milestone
Product Release Milestone
Inception Iteration(s)
Elaboration Iteration(s)
Construction Iteration(s)
Transition Iteration(s)

Lifecycle Architecture Milestone. At this point, a baseline of requirements is agreed to, you examine the detailed system objectives and scope, the choice of architecture, and the resolution of the major risks. The milestone is achieved when the architecture has been validated.

Construction: Build The Product



Incrementally define, design, implement
and more scenarios

Incrementally evolve executable architecture to complete system

Evolve architecture as you go along

Frequent demonstrations and partial deployment

Partial deployment strategy depends greatly on what system you build

Daily build with automated build process

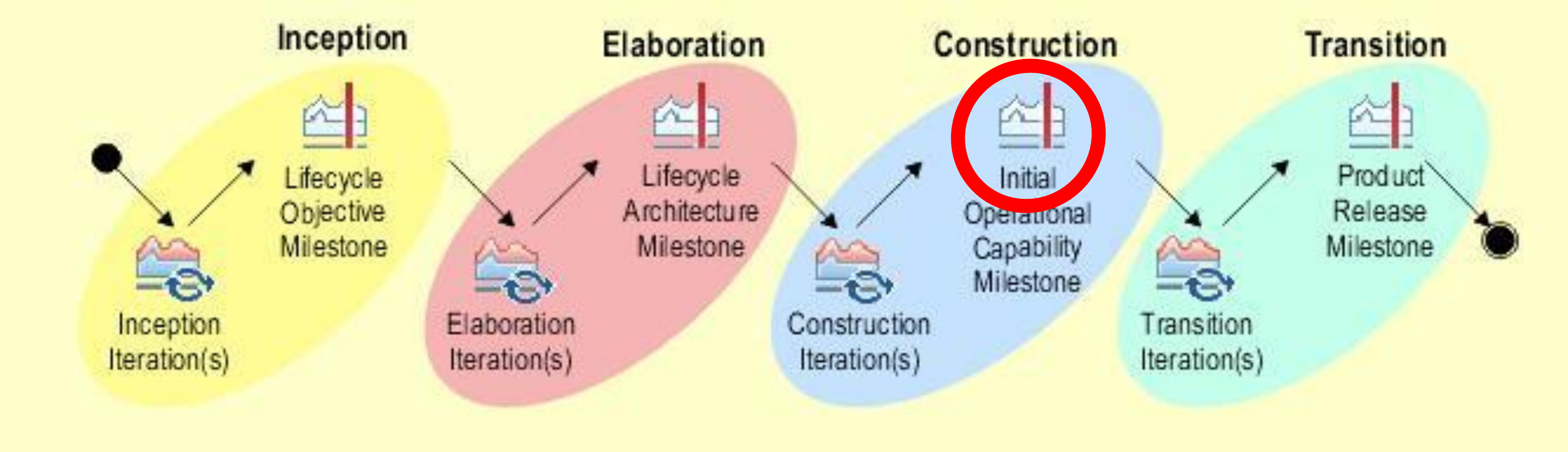
You may have to have a separate test team if you have

Complex test environments

Safety or mission critical systems

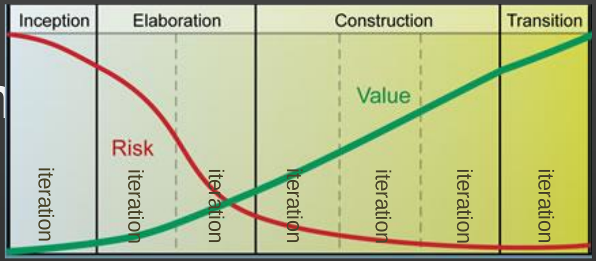
Credit: Per Kroll (IBM)

Milestones: Construction


Inception
Elaboration
Construction
Transition
Lifecycle Objective Milestone
Lifecycle Architecture Milestone
Initial Operational Capability Milestone
Product Release Milestone
Inception Iteration(s)
Elaboration Iteration(s)
Construction Iteration(s)
Transition Iteration(s)

Initial Operational Capability Milestone. At this point, the product is ready to be handed over to the transition team. All functionality has been developed and all alpha testing (if any) has been completed. In addition to the software, a user manual has been developed, and there is a description of the current release. The product is ready for beta testing.

Transition: Stabilize and Deploy



Project moves from focusing on to stabilizing and tuning

Produce incremental ‘bug-fix’ releases

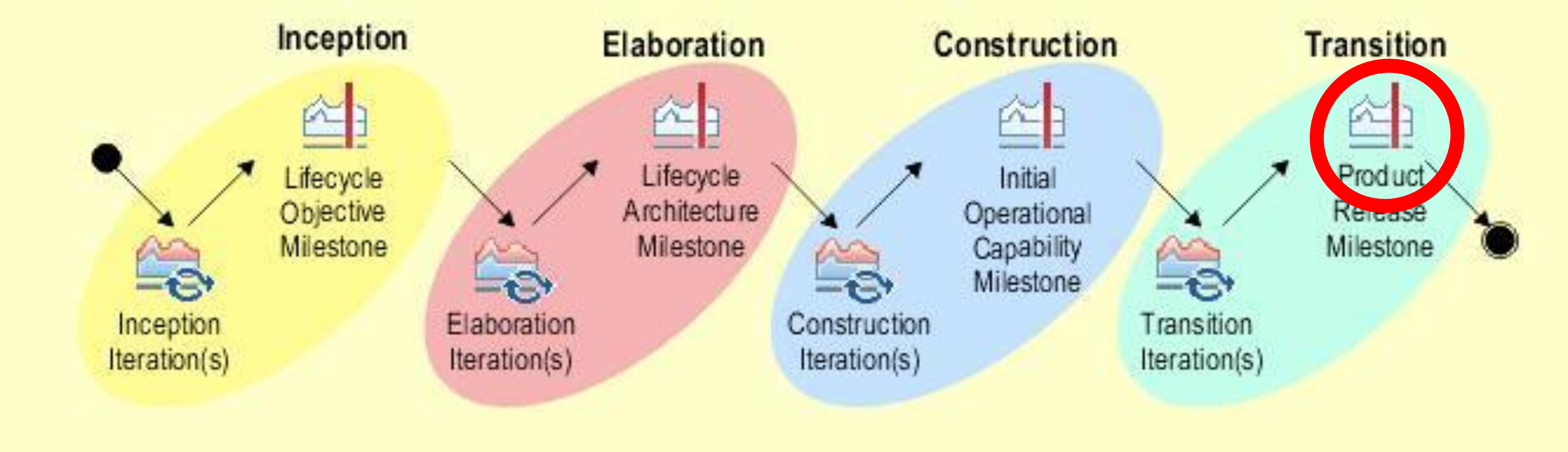
Update user manuals and deployment documentation

Execute cut-over

Conduct “post-mortem” project analysis

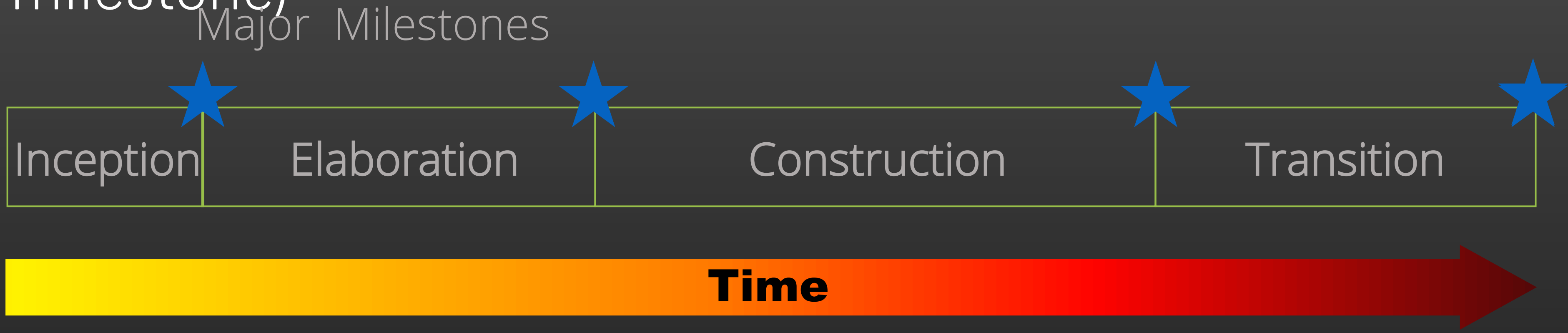
Credit: Per Kroll (IBM)

Milestones: Transition


Inception
Elaboration
Construction
Transition
Lifecycle Objective Milestone
Lifecycle Architecture Milestone
Initial Operational Capability Milestone
Product Release Milestone
Inception Iteration(s)
Elaboration Iteration(s)
Construction Iteration(s)
Transition Iteration(s)

Product Release Milestone. At this point, you decide if the objectives were met, and if you should start another development cycle. The Product Release Milestone is the result of the customer reviewing and accepting the project deliverables.

Recap main control points (lifecycle objective milestone)



Inception: **Agreement on overall scope**

Vision, high-level requirements, business case
Not detailed requirements

Elaboration: **Agreement on design approach and mitigation of major risks**

Baseline architecture, key capabilities partially implemented
Not detailed design

Construction: **Agreement on complete operational system**

Develop a beta release with full functionality

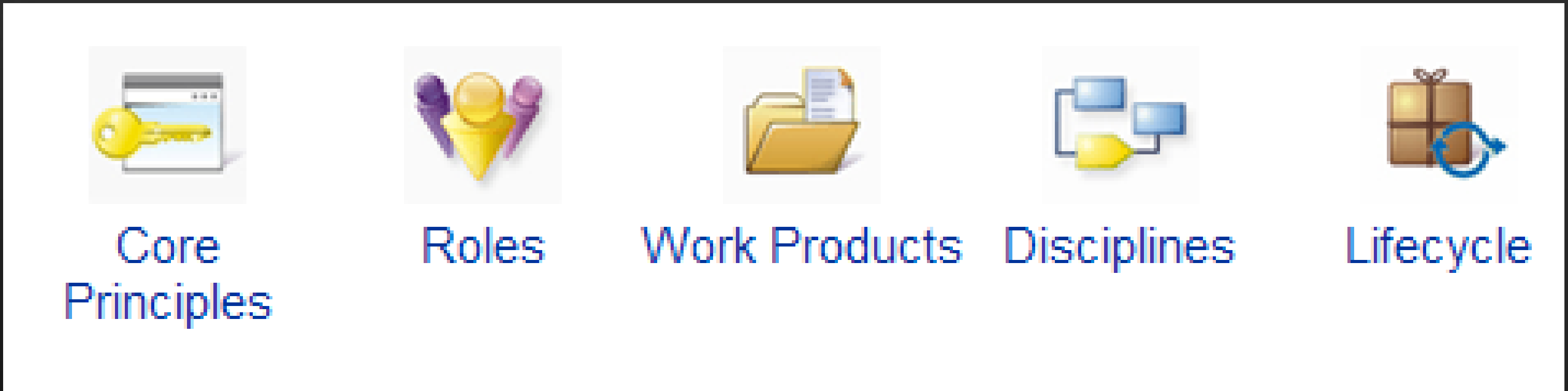
Transition: **Validate and deploy solution**

Stakeholder acceptance, cutover to production

O SDLC é concretizado em metodologias de desenvolvimento

Adotar um processo de engenharia testado & (a)provado

O que é que inclui um processo?



http://sweet.ua.pt/ico/OpenUp/OpenUP_v1514/

What is “Agility” in software development?

Effective (rapid and adaptive) response to change

Effective communication among all stakeholders

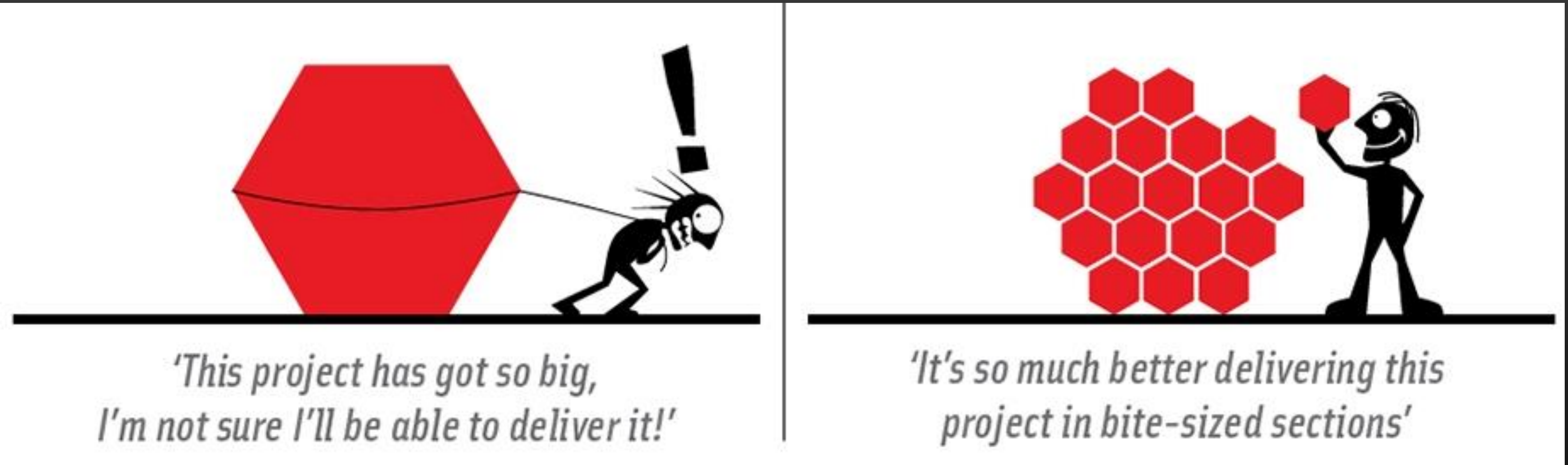
Drawing the customer onto the team

Organizing a team so that it is in control of the work performed

Yielding …

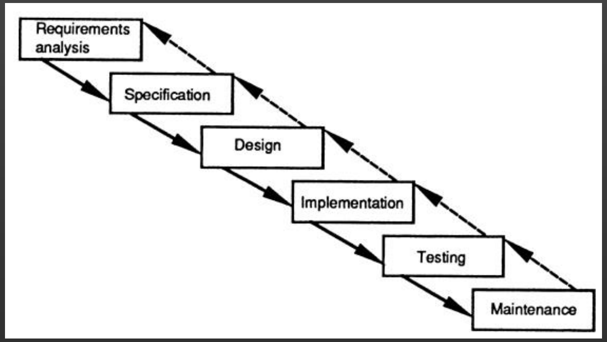
Rapid, incremental delivery of software

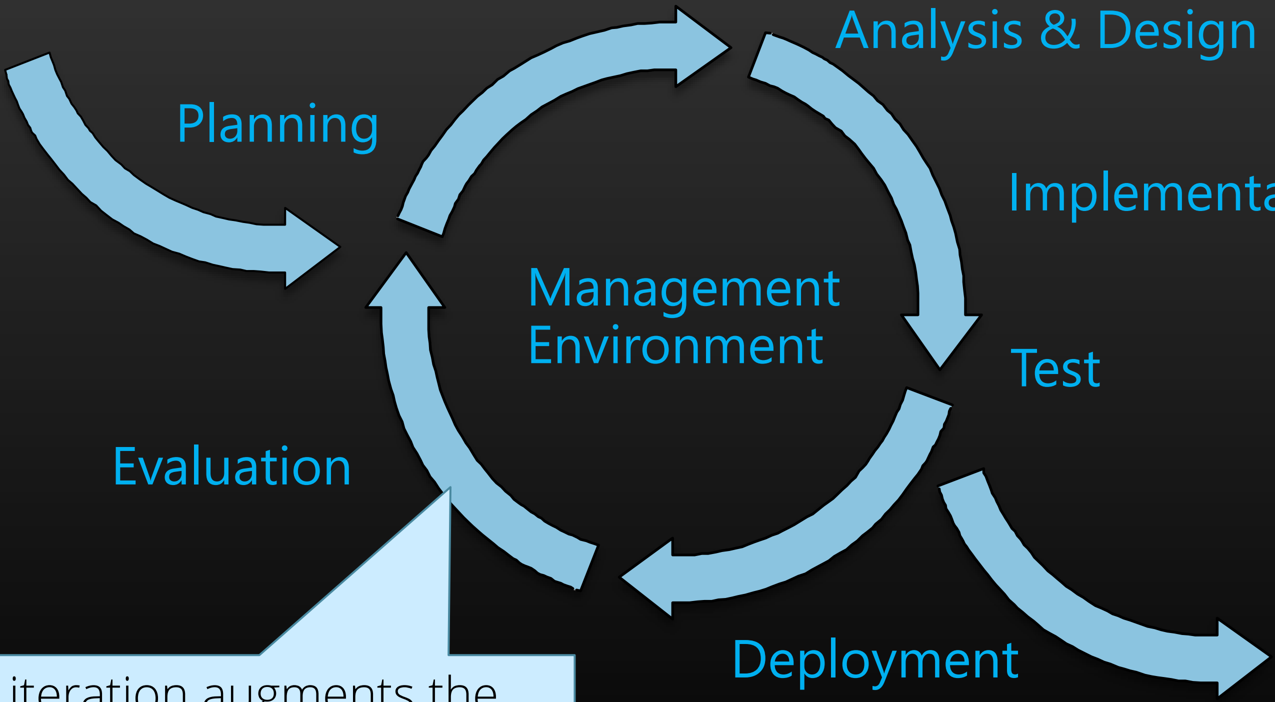
One project? Micro-projects?


'This project has got so big,
I'm not sure I'll be able to deliver it!'
'It's so much better delivering this
project in bite-sized sections'

https://blog.ganttpro.com/en/waterfall-vs-agile-with-advantages-and-disadvantages/

Iterative development focuses on short and value-oriented cycles → Agile





Requirements

Analysis & Design

Planning

Implementation

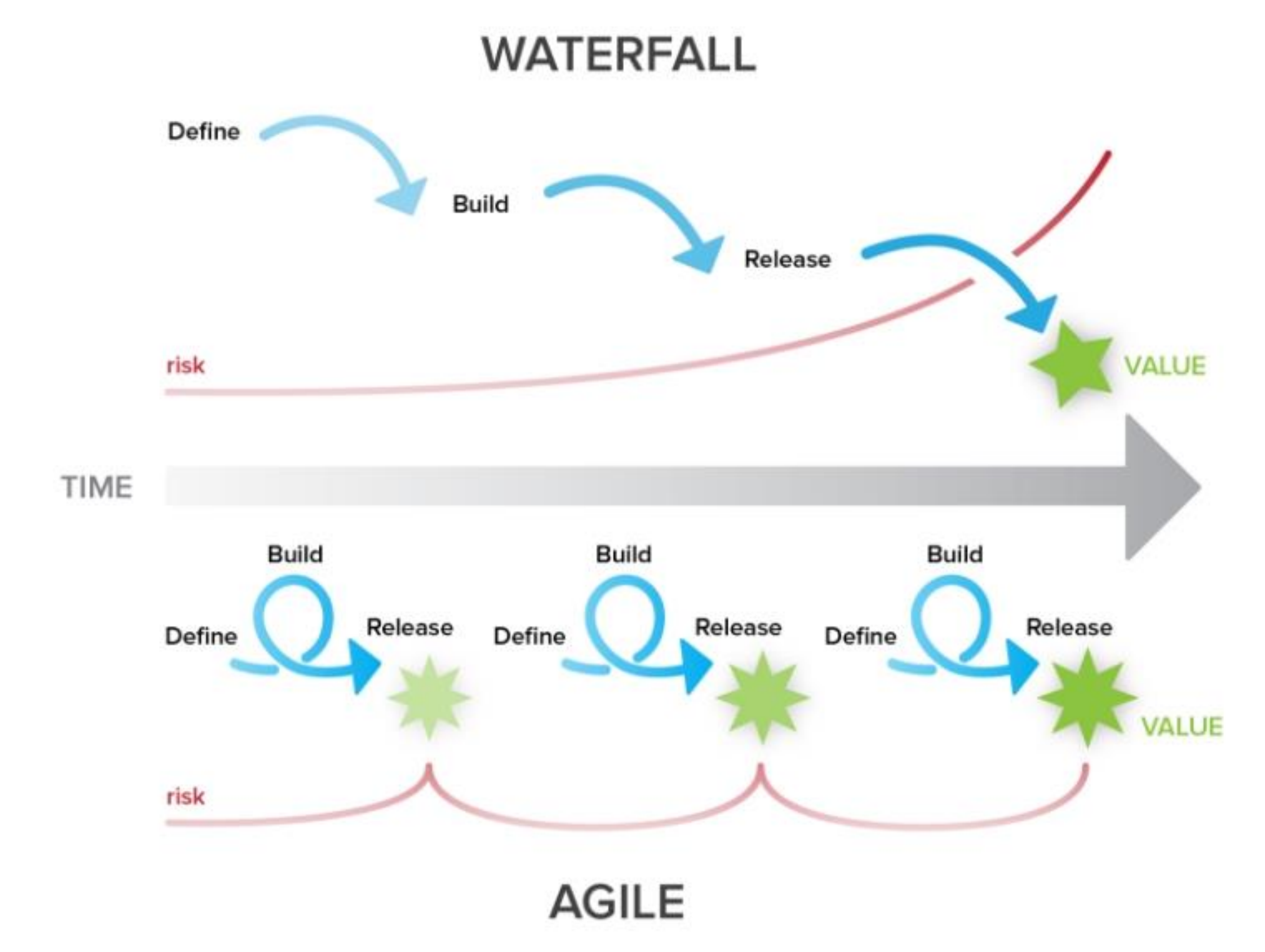
Management Environment

Test

Evaluation

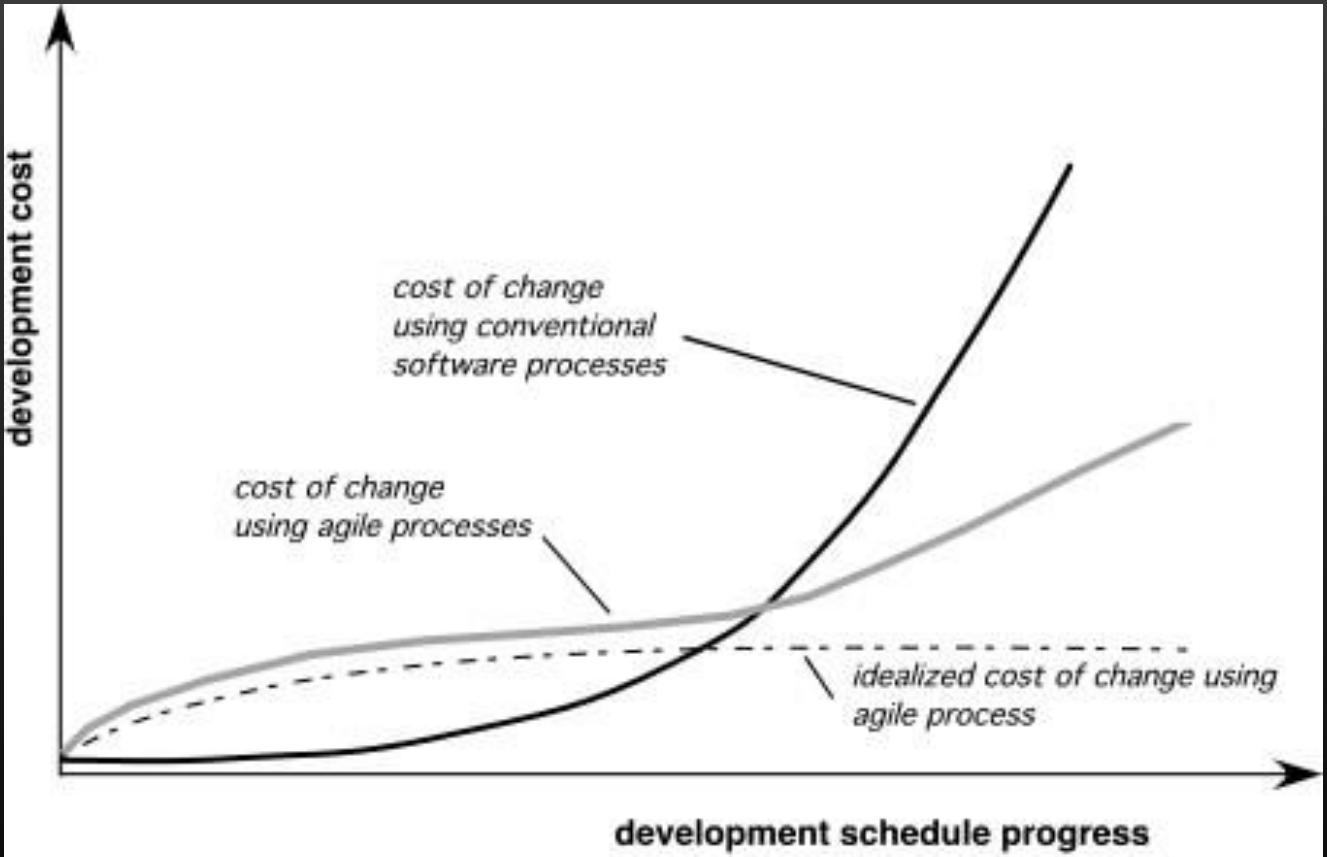
Deployment

Each iteration augments the solution by integrating some executable result



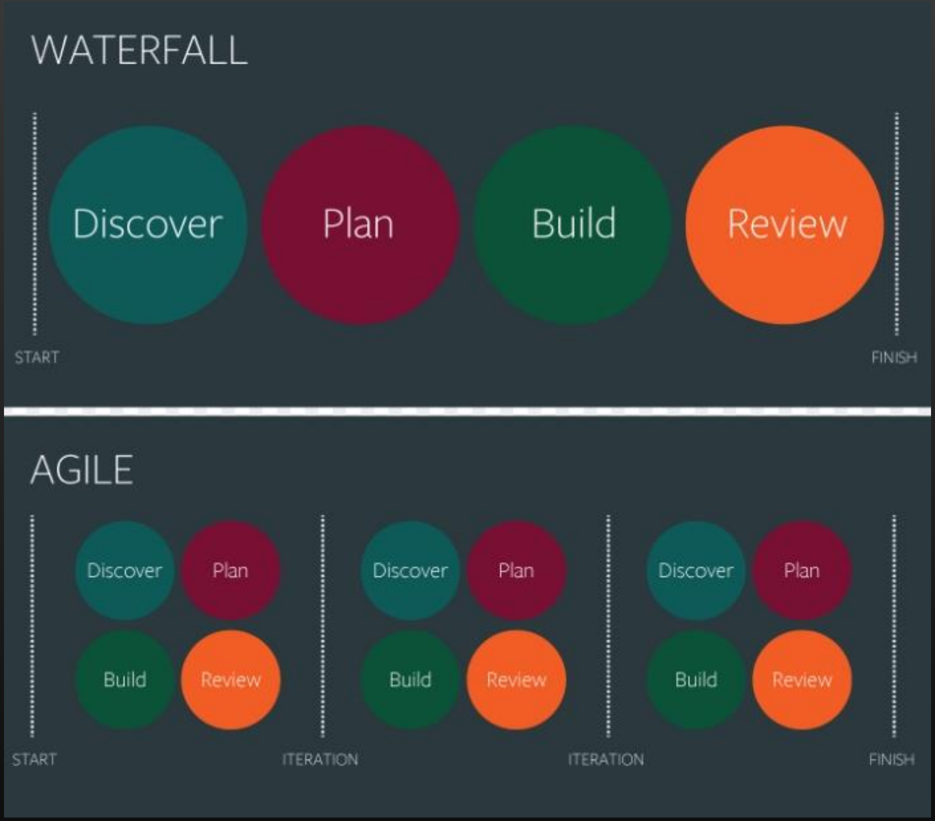
https://blog.ganttpro.com/en/waterfall-vs-agile-with-advantages-and-disadvantages/

Agility and the Cost of Change



The cost of change increases nonlinearly as the project progresses

To be (agile) or not to be...



Iterative development (short cycles) *vs* linear development through stages?

Frequent business interaction *vs* fluctuations in stakeholder's participation?

Best to have good collaboration or a good plan?

Welcome changes to mitigate risk *vs* avoid changes to control risk?

An Agile Process

Is driven by customer descriptions of what is required (scenarios)

Recognizes that plans are short-lived

Develops software iteratively with a heavy emphasis on construction activities

Delivers multiple ‘software increments’

Adapts as changes occur

Is OpenUP an agile process?

Readings & references

Core readings	Suggested readings
• [Pressman’15] – Chap. 4, 5	• [Dennis’15] – Chap 1.