


UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior  
de Ingeniería Informática  
Departamento de Lenguajes  
y Sistemas Informáticos

# Software Engineering Basics

*Software Engineering and Databases Group  
Department of Computer Languages and Systems  
University of Seville  
February 2016*

La traducción de este material docente ha sido financiada mediante la convocatoria 1.10B - Ayudas de innovación y mejora docente, convocatoria 2013-2014, modalidad B del II Plan Propio de Docencia de la Universidad de Sevilla. No ha habido financiación alguna para este proyecto de otros soportes.




UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior  
de Ingeniería Informática  
Departamento de Lenguajes  
y Sistemas Informáticos

Software Engineering Basics

- Learning objectives
  - Review basic **Software Engineering** concepts:
    - Software **project**
    - **Success** and **failure** causes in software projects
    - Software project **deliverables**
    - Software project **lifecycles**
  - Review Information Systems **management levels**.

UNIVERSIDAD DE SEVILLA



Escuela Técnica Superior de Ingeniería Informática

Departamento de Lenguajes y Sistemas Informáticos

1. Software project

2. CHAOS reports

3. Software project deliverables

4. Software project lifecycles

5. Information systems

Software Engineering Basics


• The concept of software project

– Temporary **effort** performed to create a **unique** software **product** or **service**.

– Developed by **people**.

– It must be limited in **time** and **cost**.

– It must be **planned**, **executed** and **controlled**.




February 2016

Requirements Engineering

2

UNIVERSIDAD DE SEVILLA



Escuela Técnica Superior de Ingeniería Informática

Departamento de Lenguajes y Sistemas Informáticos

1. Software project

2. CHAOS reports





3. Software project deliverables

4. Software project lifecycles

5. Information systems

Software Engineering Basics

• Roles in a software project (I)

	<b>Project Manager</b>	Responsible for project execution, with executive capacity to make decisions in agreement with the customer.
	<b>Requirements engineer</b>	Also known as <i>analyst</i> . Responsible for (1) interacting with customers & users to obtain their needs, and (2) for requirements management and development.
	<b>Development team</b>	All the people involved in software development: software architects, UI designers, programmers, test managers, DB managers, etc.
	<b>Quality assessment team</b>	A group of people responsible for the quality of the resulting products, i.e. documentation and software. They are usually responsible for process quality as well.


February 2016

Requirements Engineering

3

RE

2



UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior  
de Ingeniería Informática  
Departamento de Lenguajes  
y Sistemas Informáticos

1. Software project

2. CHAOS reports




3. Software project deliverables

4. Software project lifecycles

5. Information systems

Software Engineering Basics


Roles in a software project (II)

	<b>Customer</b>	Responsible for project funding with executive capacity to make decisions. She usually has a global vision of the business model.
	<b>User</b>	Potential user of the software to be developed in the project with a detailed, sometimes partial, vision of the business model.
	<b>Customer IT manager</b>	Responsible for customer technological environment on which the system to be develop must be integrated.

February 2016

Requirements Engineering

4



UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior  
de Ingeniería Informática  
Departamento de Lenguajes  
y Sistemas Informáticos

1. Software project

2. CHAOS reports

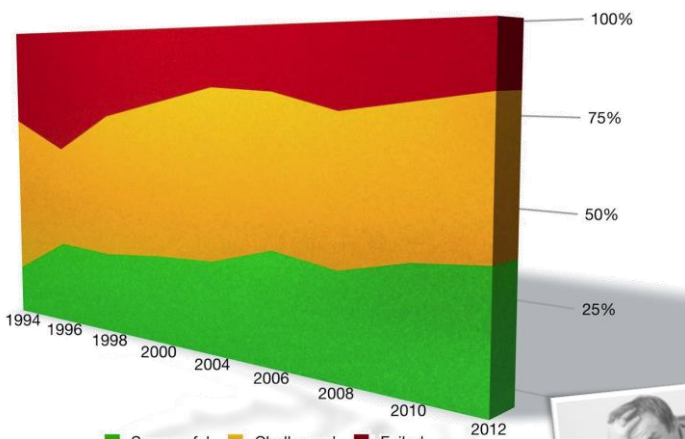
3. Software project deliverables

4. Software project lifecycles

5. Information systems

Software Engineering Basics

The CHAOS reports (1996 → 2012)




Source: <http://www.griddynamics.com/mobile-app-design-part-1-management-principles-with-scrum/>

February 2016

Requirements Engineering

5



UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior de Ingeniería Informática  
Departamento de Lenguajes y Sistemas Informáticos

1. Software project

2. CHAOS reports

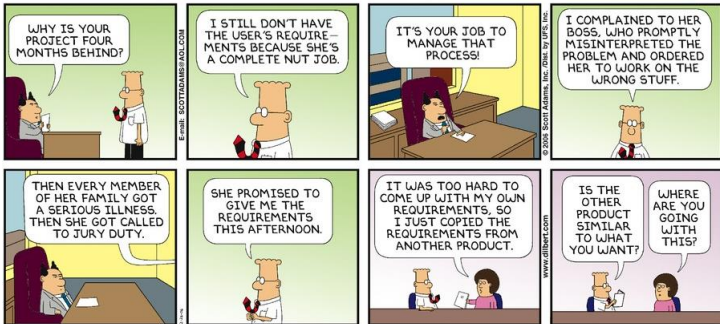
3. Software project deliverables

4. Software project lifecycles

5. Information systems

Software Engineering Basics

The CHAOS reports (1996 → 2012)




Source: <http://dilbert.com/strips/2006-02-26>

February 2016

Requirements Engineering

6



UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior de Ingeniería Informática  
Departamento de Lenguajes y Sistemas Informáticos

1. Software project

2. CHAOS reports

3. Software project deliverables

4. Software project lifecycles

5. Information systems

Software Engineering Basics

The CHAOS reports (1996 → 2012)


– Successful project factors

- User involvement
- Executive management support
- **Clear statement of requirements**
- Proper planning
- **Realistic expectations**
- Smaller project milestones
- Competent staff
- Ownership
- **Clear vision & objectives**
- Hard-working, focused staff

February 2016

Requirements Engineering

7



UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior  
de Ingeniería Informática  
Departamento de Lenguajes  
y Sistemas Informáticos

1. Software project

2. CHAOS reports

3. Software project deliverables

4. Software project lifecycles


5. Information systems

Software Engineering Basics

• The CHAOS reports (1996 → 2012)

– Challenged project factors


- Lack of user input
- Incomplete requirements & specifications
- Changing requirements & specifications
- Lack of executive support
- Technology incompetence
- Lack of resources
- Unrealistic expectations
- Unclear objectives
- Unrealistic timeframes
- New technology



February 2016

Requirements Engineering

8



UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior  
de Ingeniería Informática  
Departamento de Lenguajes  
y Sistemas Informáticos

1. Software project

2. CHAOS reports

3. Software project deliverables

4. Software project lifecycles


5. Information systems

Software Engineering Basics

• The CHAOS reports (1996 → 2012)

– Failed project factors

- Incomplete requirements
- Lack of user involvement
- Lack of resources
- Unrealistic expectations
- Lack of executive support
- Changing requirements & specifications
- Lack of planning
- Didn't need it any longer
- Lack of IT management
- Technology illiteracy




February 2016

Requirements Engineering

9

UNIVERSIDAD DE SEVILLA



Escuela Técnica Superior de Ingeniería Informática

Departamento de Lenguajes y Sistemas Informáticos

1. Software project

2. CHAOS reports

3. Software project deliverables

4. Software project lifecycles

5. Information systems

Software Engineering Basics


The CHAOS reports (1996 → 2012)

Factors of Success	Points
User involvement	20
Executive management support	15
Clear business objectives	15
Emotional maturity	12
Optimization	11
Agile process	11
Project management expertise	6
Skilled resources	5
Execution	3
Tools and infrastructure	2

Factors of Success	Points
Executive management support	20
User involvement	15
Optimization	15
Skilled resources	13
Project management expertise	12
Agile process	10
Clear business objectives	6
Emotional maturity	5
Execution	3
Tools and infrastructure	1

2010

2012




February 2016

Requirements Engineering

10

UNIVERSIDAD DE SEVILLA



Escuela Técnica Superior de Ingeniería Informática

Departamento de Lenguajes y Sistemas Informáticos

1. Software project

2. CHAOS reports

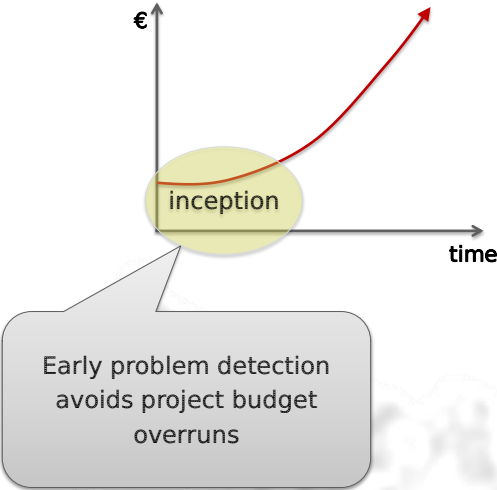
3. Software project deliverables


4. Software project lifecycles

5. Information systems

Software Engineering Basics

The cost of a change in a (traditional) project






February 2016

Requirements Engineering

11

UNIVERSIDAD DE SEVILLA



Escuela Técnica Superior de Ingeniería Informática

Departamento de Lenguajes y Sistemas Informáticos

1. Software project

2. CHAOS reports


3. Software project deliverables

4. Software project lifecycles

5. Information systems

Software Engineering Basics

- Software as a engineering product
  - The set of products to be developed and delivered to the customer during a project are known as **deliverables**.




February 2016

Requirements Engineering

12

UNIVERSIDAD DE SEVILLA



Escuela Técnica Superior de Ingeniería Informática

Departamento de Lenguajes y Sistemas Informáticos

1. Software project

2. CHAOS reports


3. Software project deliverables

4. Software project lifecycles

5. Information systems

Software Engineering Basics

- Usual products before project start
  - Request for Proposals
  - *Pliego de Prescripciones Técnicas* (public admin.)
  - Offers
  - Contracts
- They should make clear ...
  - The requirements to be met by the system.
  - The project deliverables.
  - The budget and project schedule.
  - Technical constraints.
  - Penalties for delays.
  - ...



February 2016

Requirements Engineering

13

RE

7

UNIVERSIDAD DE SEVILLA

Escuela Técnica Superior de Ingeniería Informática

Departamento de Lenguajes y Sistemas Informáticos

1. Software project

2. CHAOS reports

3. Software project deliverables



4. Software project lifecycles

5. Information systems

Software Engineering Basics

• Usual project deliverables

- Project plan
- Progress reports
- Requirements specification
- Design document
- Test plan
- Source code
- Executable software
- User manuals



February 2016

Requirements Engineering

14

UNIVERSIDAD DE SEVILLA

Escuela Técnica Superior de Ingeniería Informática

Departamento de Lenguajes y Sistemas Informáticos

1. Software project

2. CHAOS reports

3. Software project deliverables

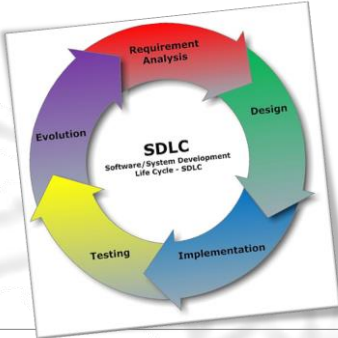
4. Software project lifecycles

5. Information systems

Software Engineering Basics

• What is the software lifecycle?

- A software project lifecycle specifies its general approach, indicating the **processes, activities and tasks** to be performed and in what order, the **products** to be developed, and which of them will be delivered to the customer in a specified order.



<https://commons.wikimedia.org>

February 2016


Requirements Engineering

15

RE

8





UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior  
de Ingeniería Informática  
Departamento de Lenguajes  
y Sistemas Informáticos

1. Software project

2. CHAOS reports

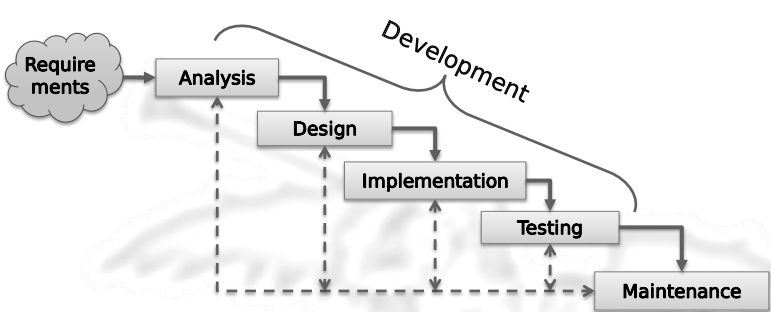
3. Software project deliverables

4. Software project lifecycles

5. Information systems

Software Engineering Basics


- Classic lifecycle (waterfall)
  - Each phase starts when the previous one finishes.
  - It is assumed that all requirements are known.
  - It takes a long time to deliver the software.
  - It is better that not following any lifecycle.
  - It is the ideal, easiest lifecycle to plan.



February 2016

Requirements Engineering

16



UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior  
de Ingeniería Informática  
Departamento de Lenguajes  
y Sistemas Informáticos

1. Software project

2. CHAOS reports


3. Software project deliverables

4. Software project lifecycles

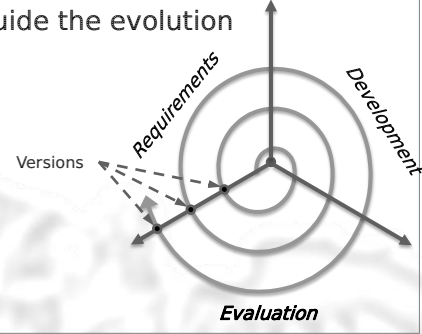
5. Information systems

Software Engineering Basics

- The evolutionary lifecycle
  - Gathering all requirements at the beginning is virtually impossible.
  - Customer & user needs evolve during development.
  - Requirements-development-evaluation cycles
  - Evaluation results guide the evolution to the next version.




Dr. Barry Boehm  
Creator spiral pattern



February 2016

Requirements Engineering

17



UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior  
de Ingeniería Informática  
Departamento de Lenguajes  
y Sistemas Informáticos

1. Software project

2. CHAOS reports


3. Software project deliverables




4. Software project lifecycles


5. Information systems




Software Engineering Basics


Incremental vs. iterative



123



123




Don't Know What I Want, But I Know How to Get It  
Jeff Patton, 2008. <http://jpattonassociates.com/>

February 2016

Requirements Engineering

18



UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior  
de Ingeniería Informática  
Departamento de Lenguajes  
y Sistemas Informáticos

1. Software project

2. CHAOS reports

3. Software project deliverables

4. Software project lifecycles

5. Information systems

Software Engineering Basics

Agile methods lifecycles

Manifesto for Agile Software Dev.

AGILE

INDIVIDUALS AND INTERACTIONS  
OVER PROCESSES AND TOOLS

WORKING SOFTWARE OVER  
COMPREHENSIVE DOCUMENTATION

CUSTOMER COLLABORATION OVER  
CONTRACT NEGOTIATION

RESPONDING TO CHANGE OVER  
FOLLOWING A PLAN


February 2016

Requirements Engineering

19

RE

10



UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior  
de Ingeniería Informática  
Departamento de Lenguajes  
y Sistemas Informáticos

1. Software project

2. CHAOS reports

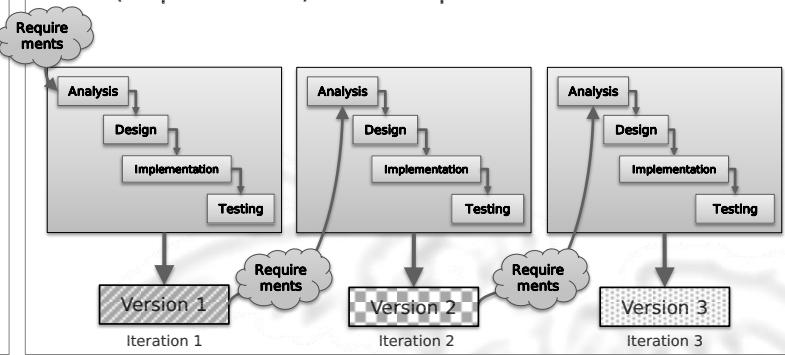
3. Software project deliverables

4. Software project lifecycles

5. Information systems


Software Engineering Basics

- Agile methods lifecycles
  - They are evolutionary lifecycles with **short iterations** to improve communication with customers & users.
  - In each iteration, new customers & users requests (requirements) are incorporated.



Iteration 1      Iteration 2      Iteration 3

February 2016      Requirements Engineering      20



UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior  
de Ingeniería Informática  
Departamento de Lenguajes  
y Sistemas Informáticos

1. Software project

2. CHAOS reports

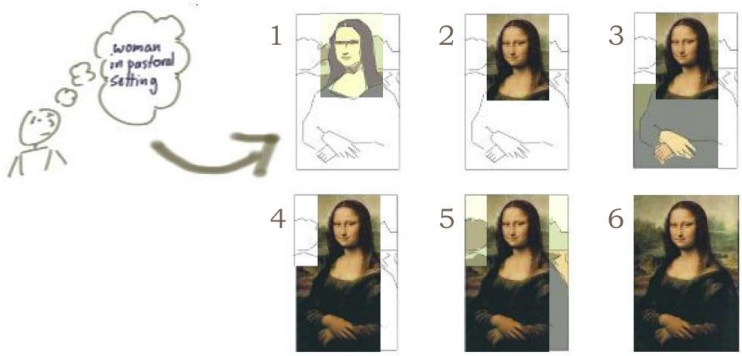
3. Software project deliverables

4. Software project lifecycles


5. Information systems

Software Engineering Basics

- Incremental and iterative in agile projects




1 2 3 4 5 6



Revisiting the Iterative Incremental Mona Lisa  
Steven Thomas, 2012. <http://itsadeliverything.com>

February 2016      Requirements Engineering      21



UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior  
de Ingeniería Informática  
Departamento de Lenguajes  
y Sistemas Informáticos

1. Software project

2. CHAOS reports

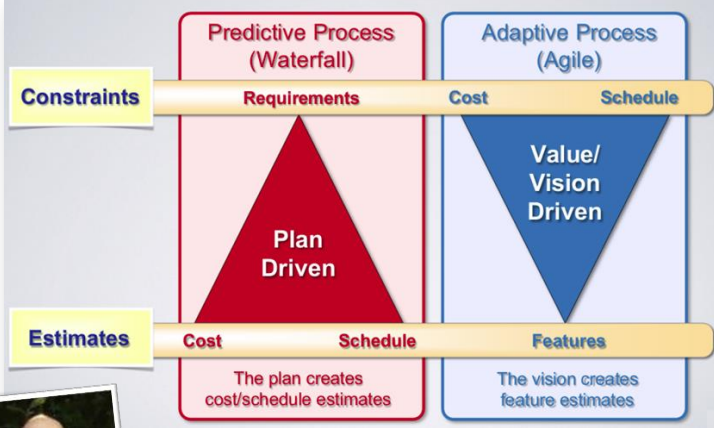
3. Software project deliverables


4. Software project lifecycles

5. Information systems

Software Engineering Basics

• Waterfall vs. agile lifecycles






Waterfall, Agile & the "Triple Constraint"  
Tom Sylvester, 2013. <http://tom-sylvester.com/>

February 2016

Requirements Engineering

22



UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior  
de Ingeniería Informática  
Departamento de Lenguajes  
y Sistemas Informáticos

1. Software project

2. CHAOS reports

3. Software project deliverables


4. Software project lifecycles

5. Information systems

Software Engineering Basics

• Waterfall vs. agile lifecycles


Whiteboard: How Can You Make Waterfall More Agile?



February 2016

Requirements Engineering

23



UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior de Ingeniería Informática  
Departamento de Lenguajes y Sistemas Informáticos


1. Software project

2. CHAOS reports

3. Software project deliverables

4. Software project lifecycles

5. Information systems



Software Engineering Basics

Customer Requirements

Product Requirements

Design Architecture

Implementation Components

Acceptance Tests

System tests

Integration Tests

Unit Tests

validate

validate


validate

validate

February 2016

Requirements Engineering

24



UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior de Ingeniería Informática  
Departamento de Lenguajes y Sistemas Informáticos


1. Software project

2. CHAOS reports

3. Software project deliverables

4. Software project lifecycles

5. Information systems



Software Engineering Basics

Organization management levels

Information systems should help organizations to...

Make competitiveness **strategic decisions.**

Make business **tactical decisions.**

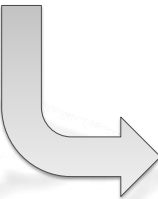
Perform **business processes** and their associated **operations.**

Strategic

Tactical

Operational

Big Data




February 2016

Requirements Engineering

25

RE

13



UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior  
de Ingeniería Informática  
Departamento de Lenguajes  
y Sistemas Informáticos

1. Software project

2. CHAOS reports

3. Software project deliverables

4. Software project lifecycles

5. Information systems

Software Engineering Basics


• Management levels of an organization

– Information systems software...

• It is the most commonly developed on demand.

• It is the subject of most methodologies.

• It is the kind of software where **requirements** are most important.




Source: O'Brien and Marakas, *Introduction to Information Systems*, 15th edition,

February 2016

Requirements Engineering

26



UNIVERSIDAD DE SEVILLA  
Escuela Técnica Superior  
de Ingeniería Informática  
Departamento de Lenguajes  
y Sistemas Informáticos

1. Software project

2. CHAOS reports


3. Software project deliverables

4. Software project lifecycles

5. Information systems

Software Engineering Basics

• Comments, suggestions, ...



February 2016

Requirements Engineering

27