Centro de Investigación
en Métodos de
Producción de Software

Fourth International Workshop on Requirements Engineering Visualization (REV'09)

Allowing End-users to Actively Participate within the Elicitation of Pervasive System Requirements through Immediate Visualization

Francisca Pérez and Pedro Valderas

UNIVERSIDAD
POLITECNICA
DE VALENCIA

Research Centre on Software Production Methods
Technical University of Valencia. Spain.

Outline

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- Contribution
- Immediate Natural Visualization
- A tool for Supporting the Immediate Visualization of Pervasive Systems
- Requirements Elicitation Process
- Example. An end-user description
- Conclusions and Future work

Motivation

- Efficient requirements engineering activities are essential in order to develop software systems that properly **satisfy user needs**. These activities are even more important in the particular case of **pervasive systems.**
- Changes in the requirements of a pervasive system once the development process has already started can require changes in the software and in the hardware infraestructure. **These changes imply additional effort, time and money.**
- End-users do not understand the jargon of software developers and developers often do not understand the jargon of end-users. **Problems of understanding.**

Motivation

Goal: involve end-users in the requirements elicitation process in an active way

***Natural* Requirements Elicitation technique**

Natural is a concept that is used in the field of end-user development, which is defined as "faithfully representing nature or life"; this implies that it works in accordance with the way people expect.

Contributions

Natural Requirements Elicitation technique

Immediate **Natural** ***Visualization***

A **tool** for supporting the Immediate Visualization of Pervasive Systems

Requirements Elicitation Process

Immediate Natural Visualization

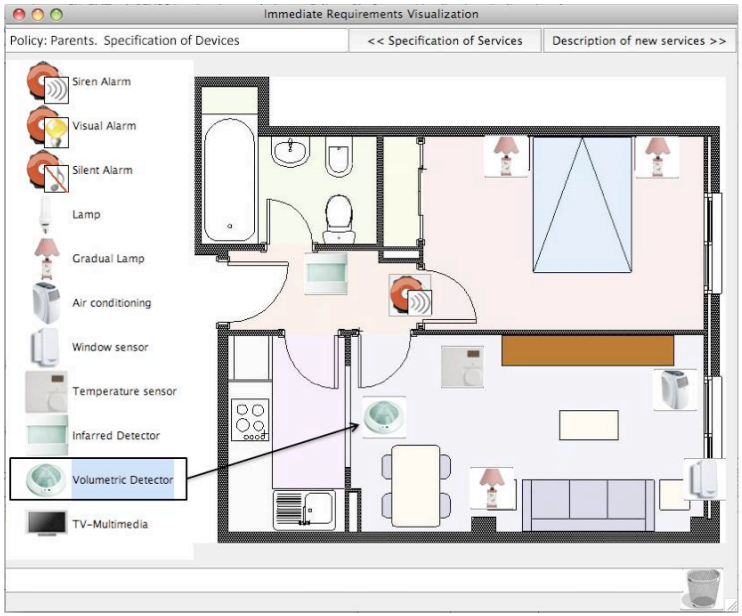
- **Information visualization** is concerned with the visualization of a large amount of data and its representation in a comprehensive and natural way for end-users.
- We define **immediate visualization** as offering end-users a natural visualization of the needs that they have just described on their own.
- To select the appropriate representation of the visualization, we are inspired by **well-accepted techniques and metaphors in the field of End-user Development**: Natural Programming, Visual Programming, and Jigsaw metaphor.

A tool for Supporting the Immediate Visualization of Pervasive Systems

- In order to allow end-users to describe their needs within the development process of a pervasive system, we have developed **a prototype of an elicitation tool**.

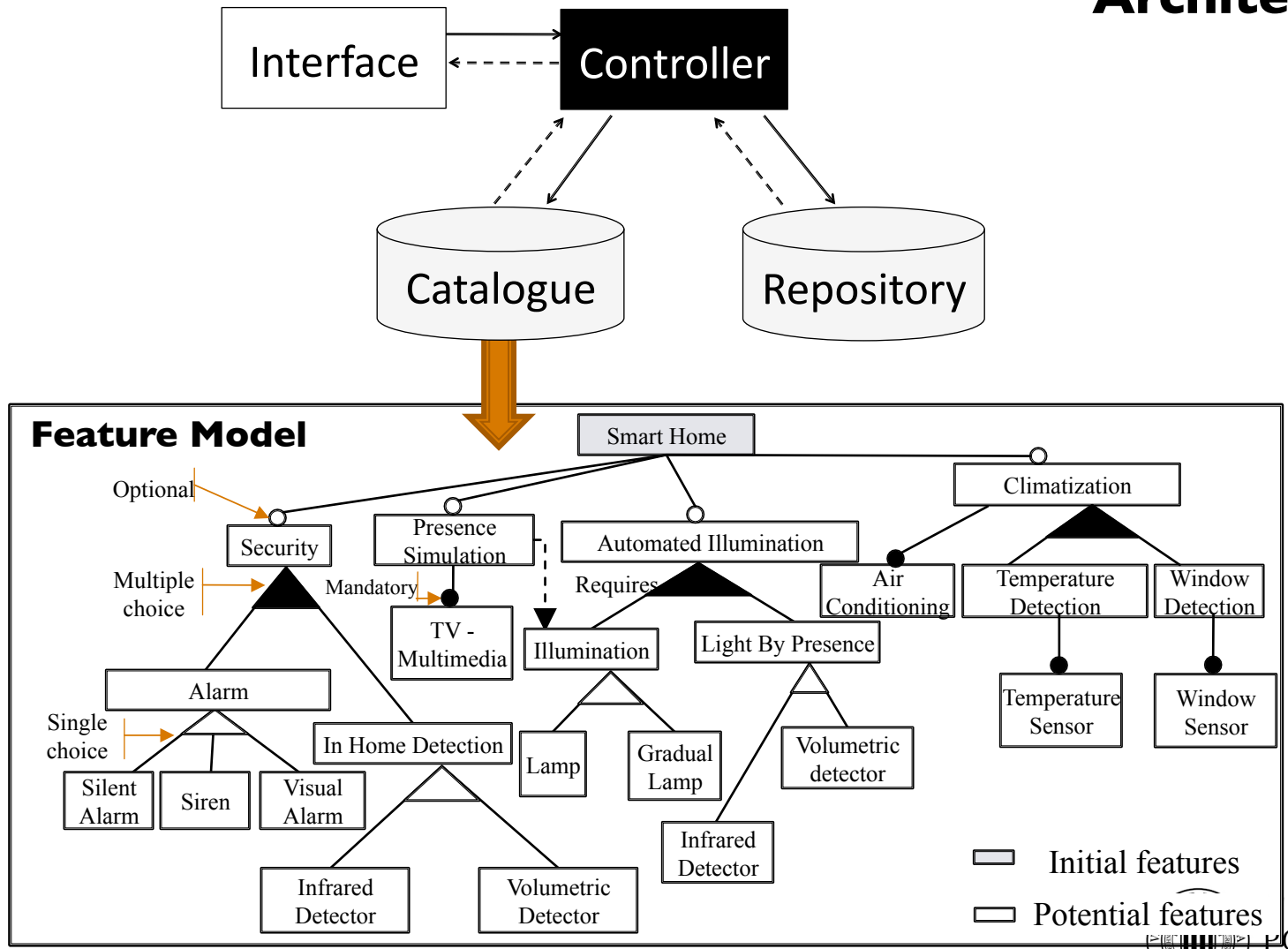
- This tool allows end-users to describe their needs and visualize them in an immediate way.

Snapshot of our prototype specifying devices



A tool for Supporting the Immediate Visualization of Pervasive Systems

Architecture

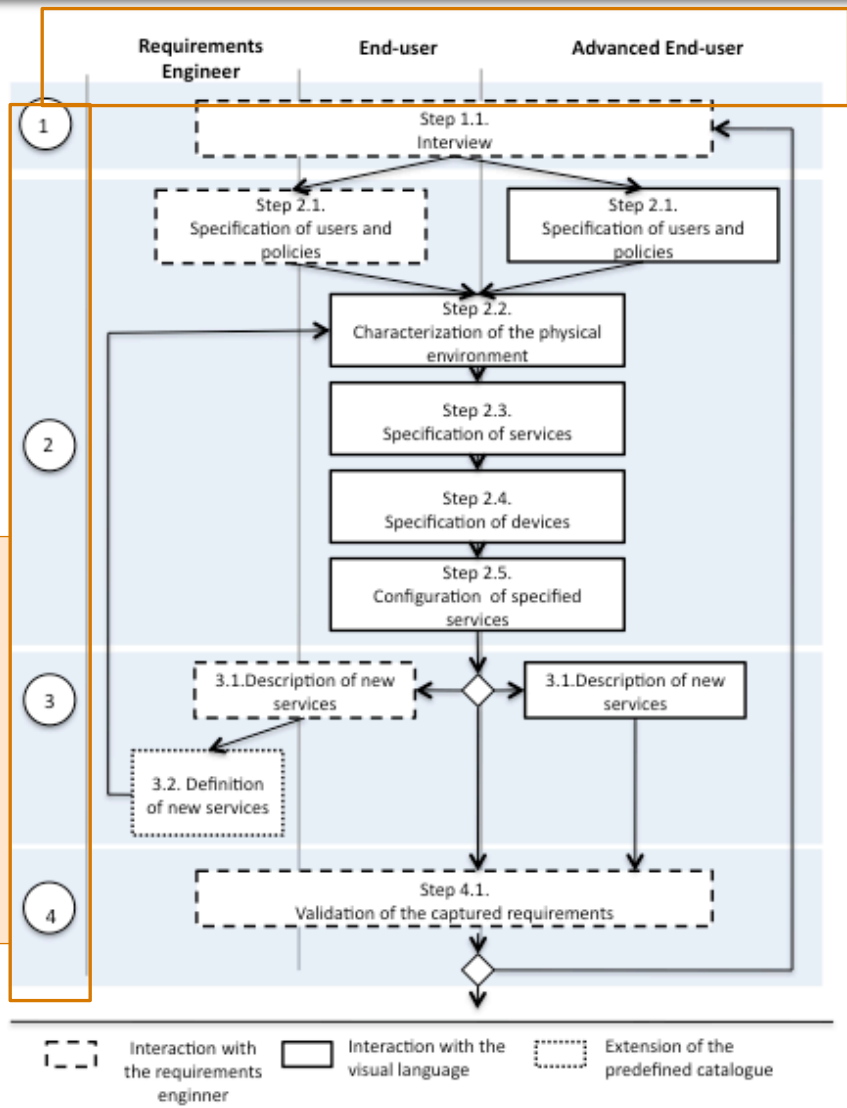


Requirements Elicitation Process

• This process determines the steps that end-users must follow to create a system description and how end-users and requirements engineers must interact with each other.

Phases:

1. ***Context scope***
2. ***System specification***
3. ***Advanced system***
4. ***Validation***



Requirements Elicitation Process

Phase 1.Context scope

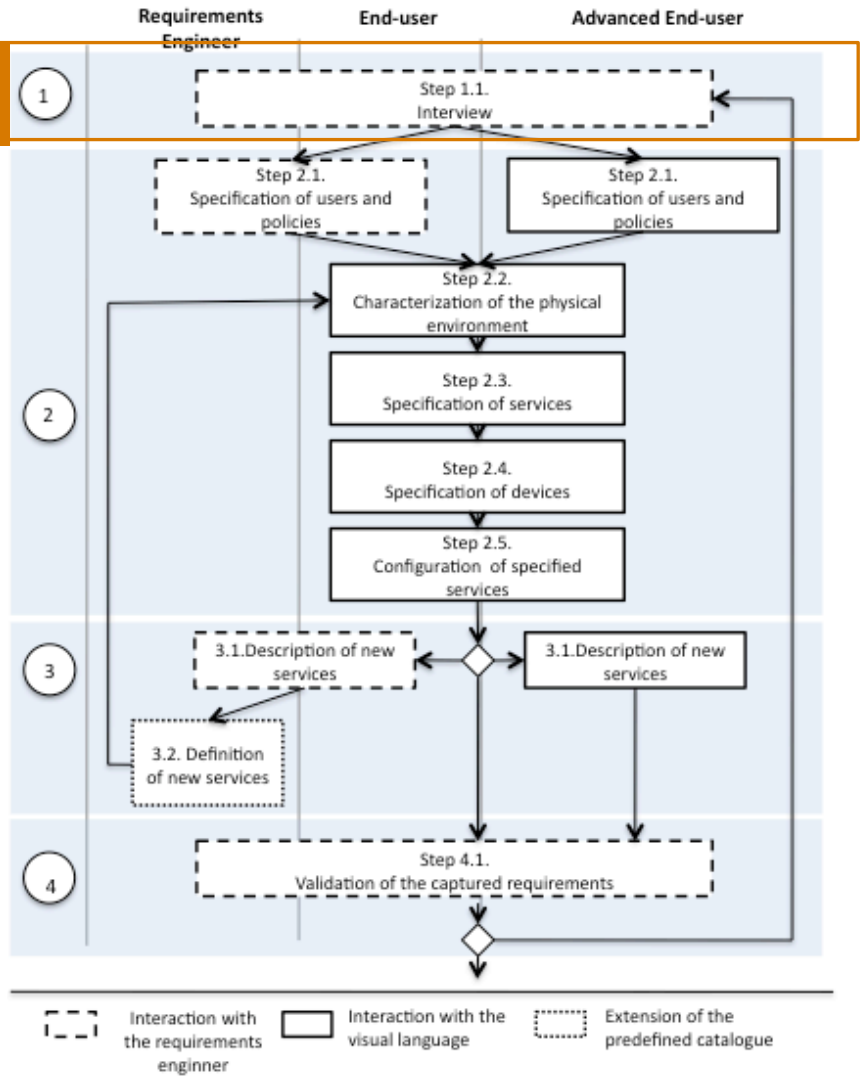
Requirements engineer

Determine the characteristics of end-user context scope ***(domain and end-user profile)*** *through traditional interviews*

Prepares the end-user tool *in order to allow end-users to interact with a natural interface adapted to their characteristics*

Advanced end-user: ***Open-option interface***

End-user: ***Closed-option interface***

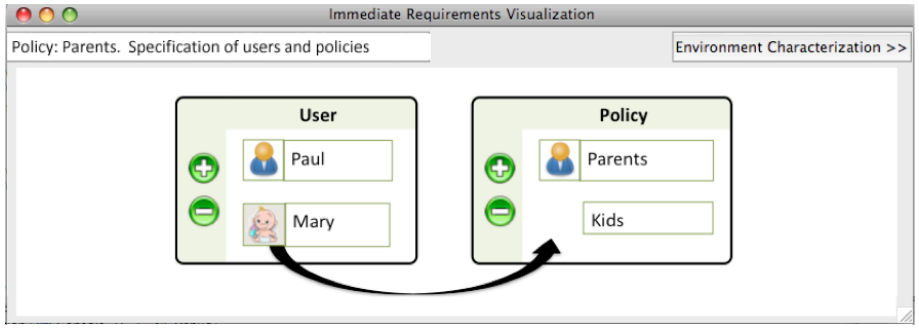


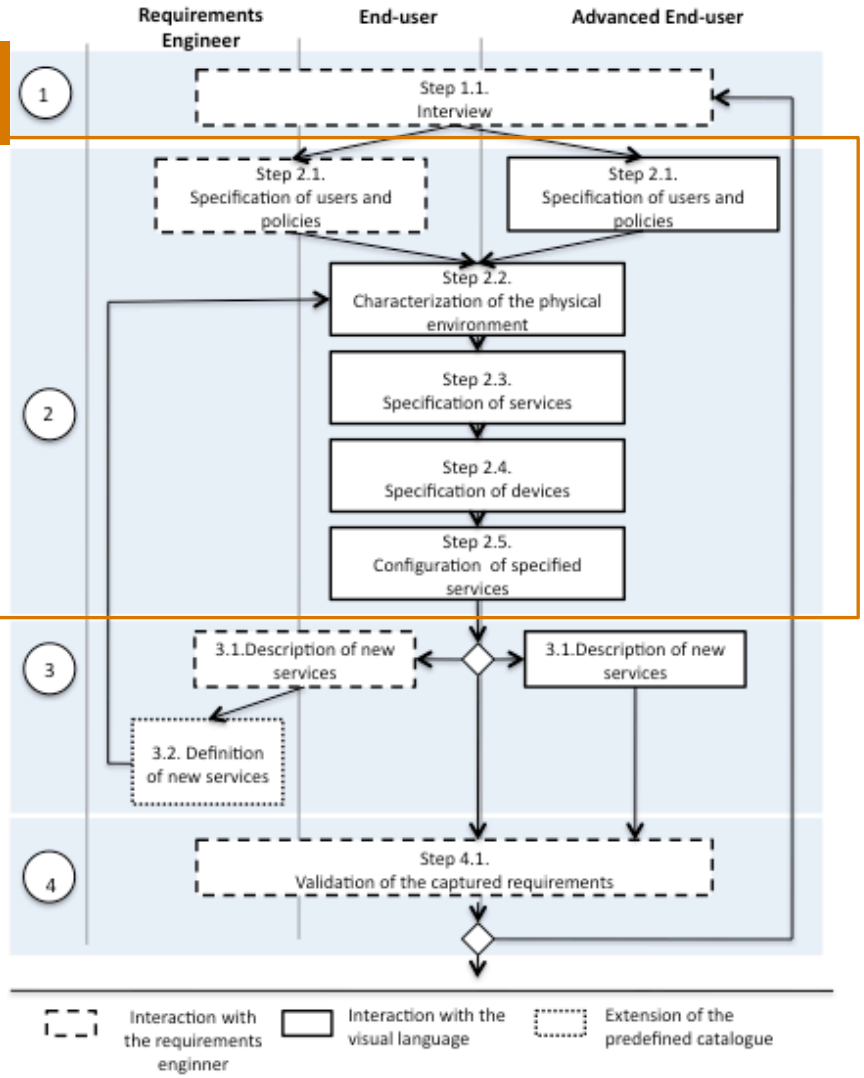
Requirements Elicitation Process

Phase 2. System specification

Step 2.1: end-users must describe the users who are allowed to use the system, their desired policies, and the links between user and policy.

Visualization:



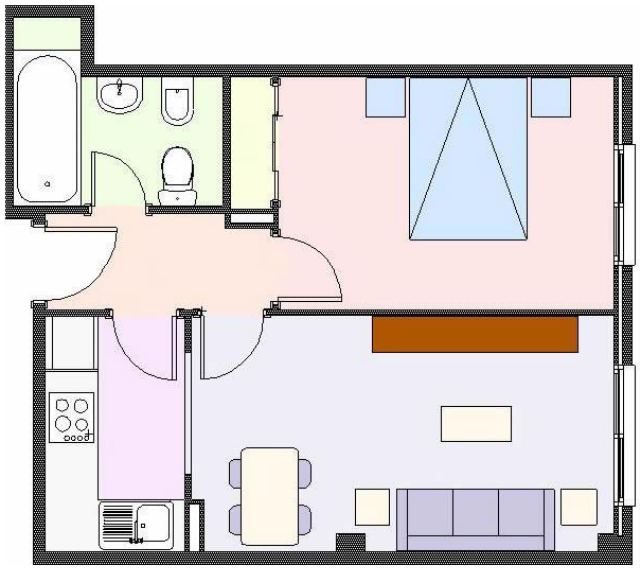


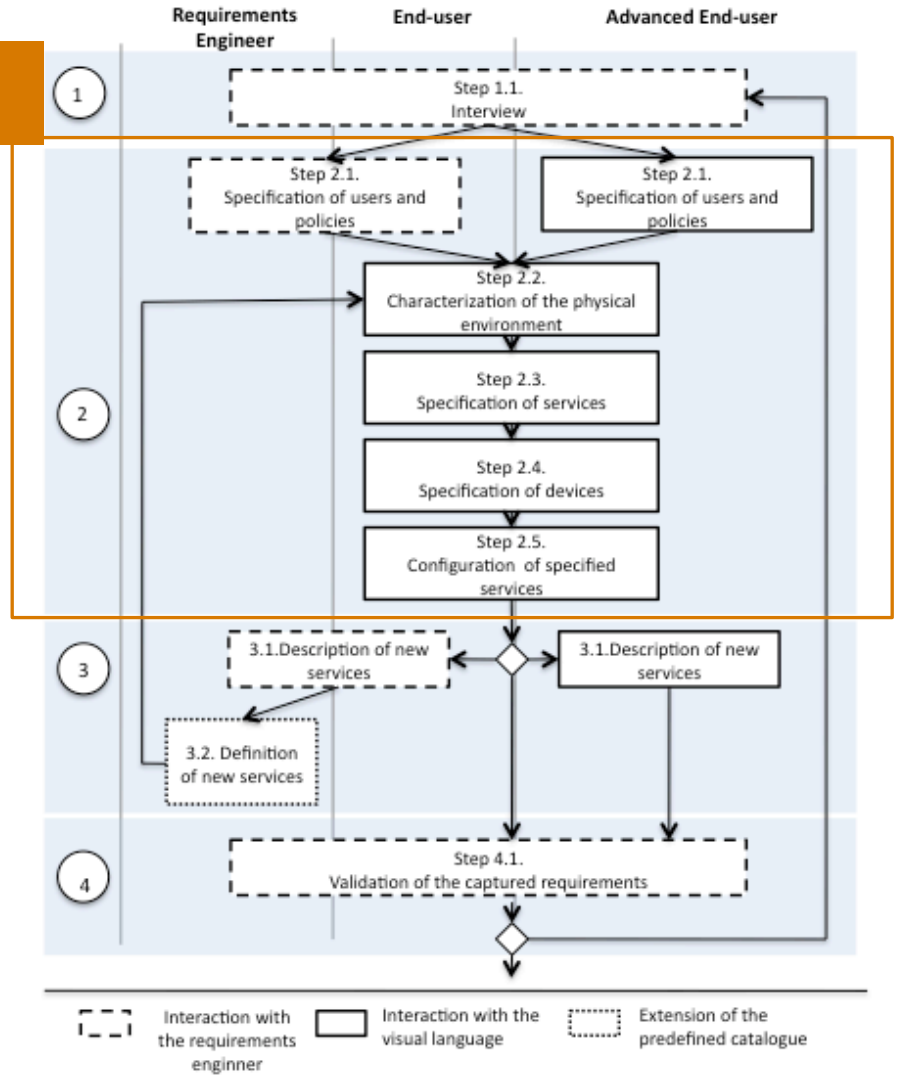
Requirements Elicitation Process

Phase 2. System specification

Step 2.2: end-users must characterize the physical environment in which the system must be deployed

Visualization:

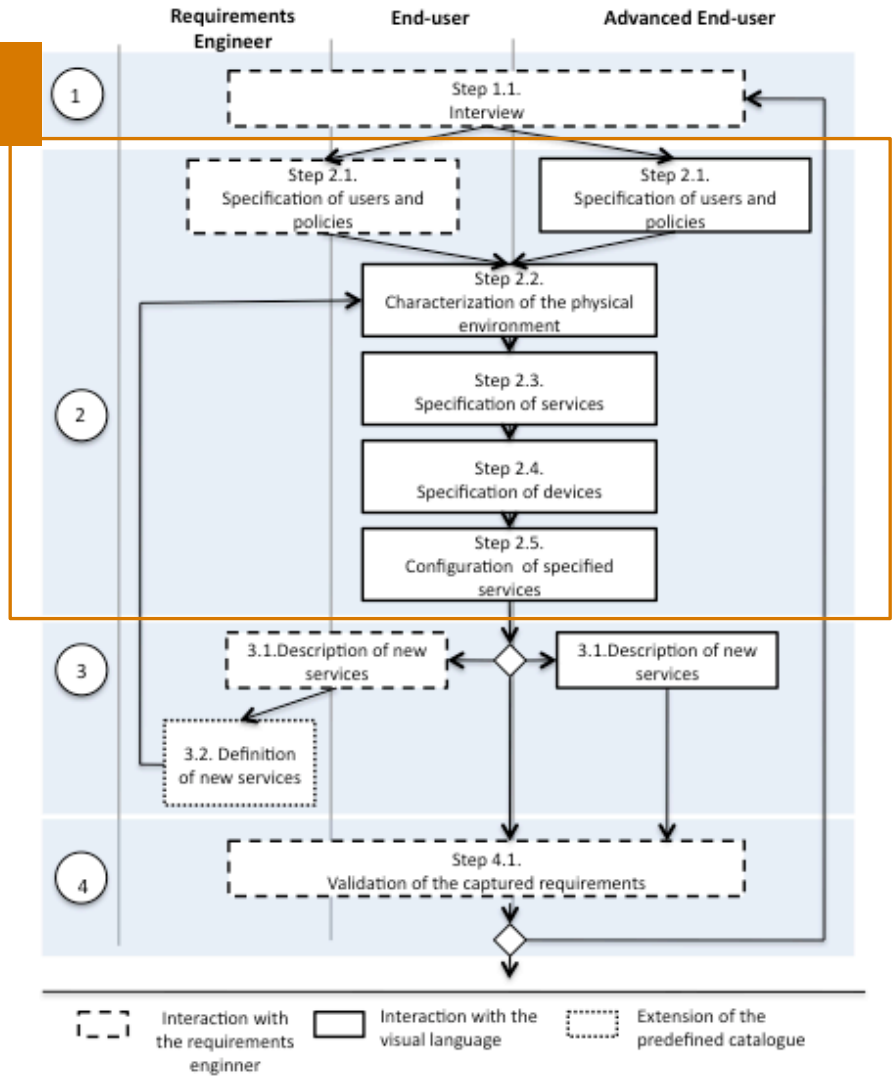




Requirements Elicitation Process

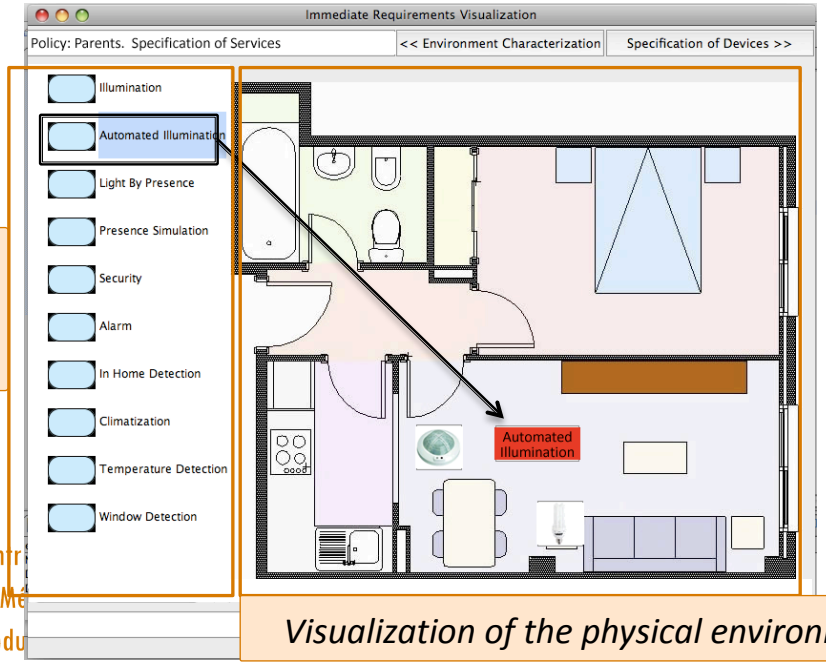
Phase 2. System specification

Step 2.3: end-users must specify the **services** needed in their physical environment and where they are located (e.g. Automated Illumination service in the living room).



Visualization:

List of services available



Visualization of the physical environment

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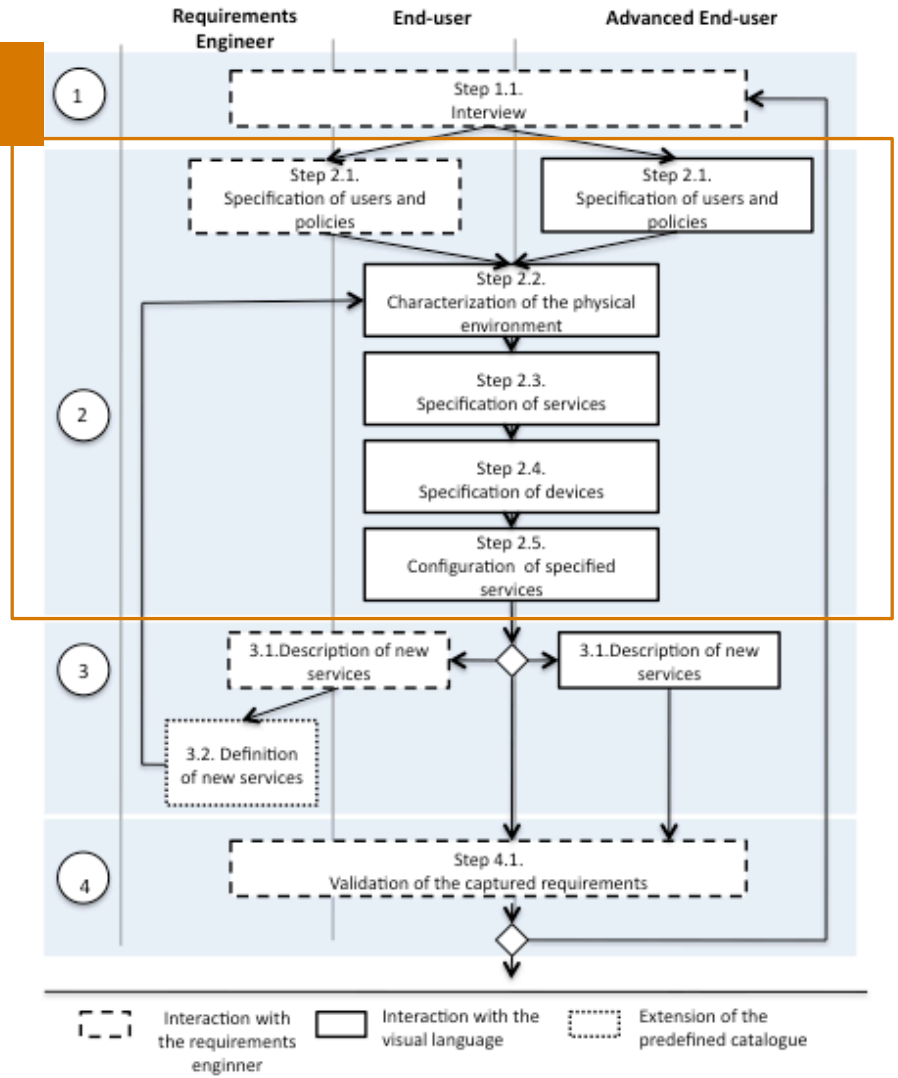
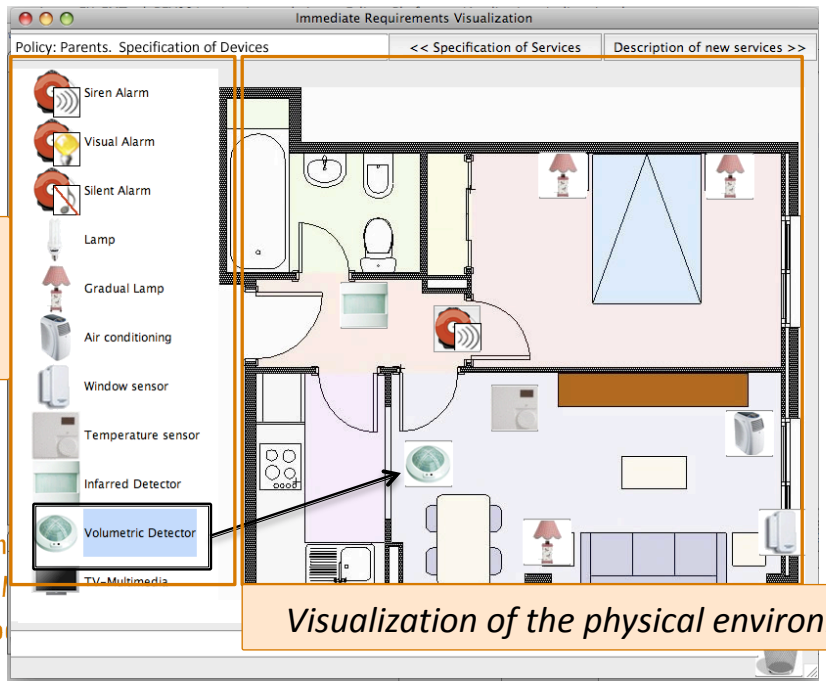
Requirements Elicitation Process

Phase 2. System specification

Step 2.4: end-users must specify the **devices** that are available in each location



Visualization:



List of devices available

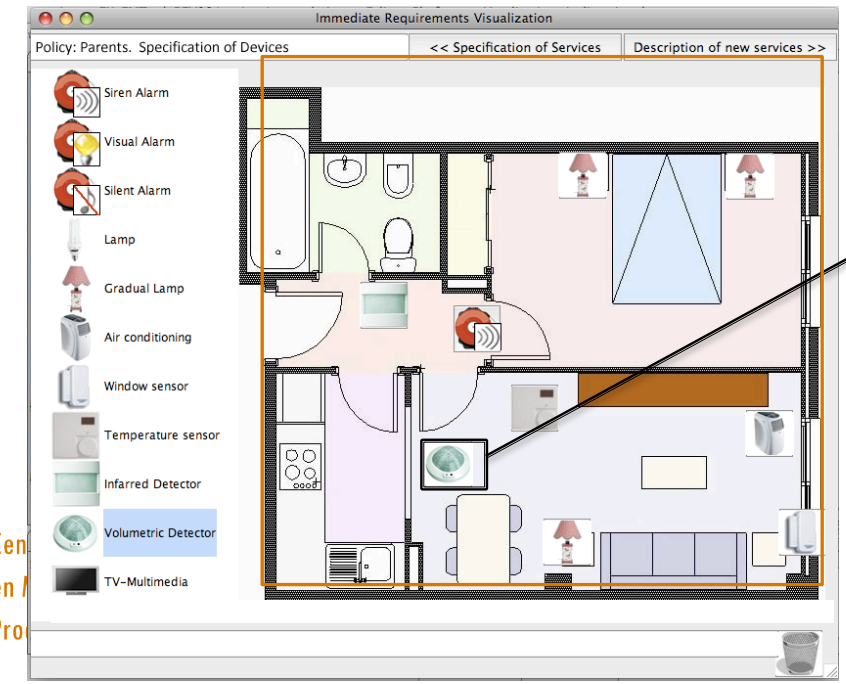
Visualization of the physical environment

Requirements Elicitation Process

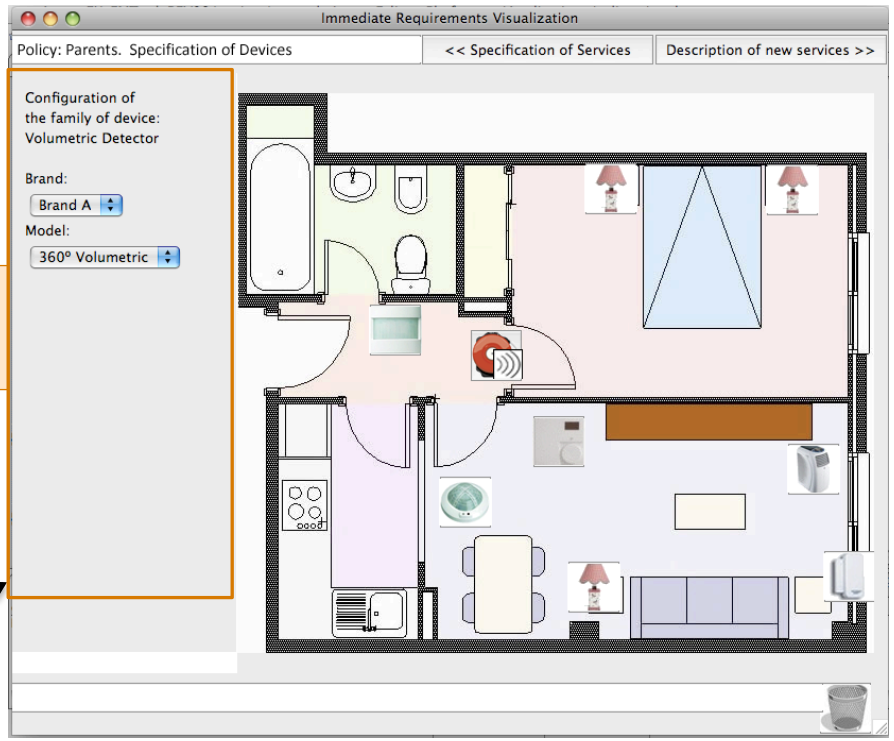
Phase 2. System specification

Step 2.4: end-users must specify the **devices** that are available in each location

Visualization:



Specification of a device



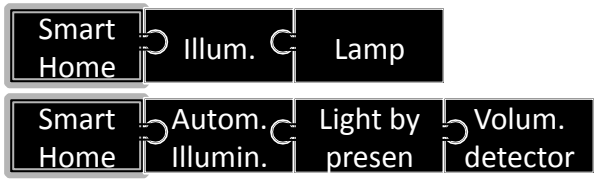
Requirements Elicitation Process

Phase 2. System specification

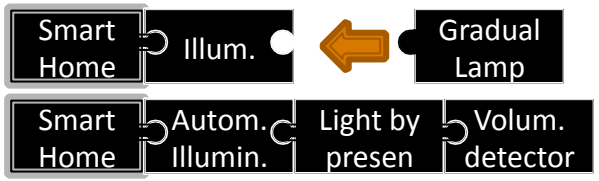
Step 2.5: end-users are able to define the configuration of each specified service

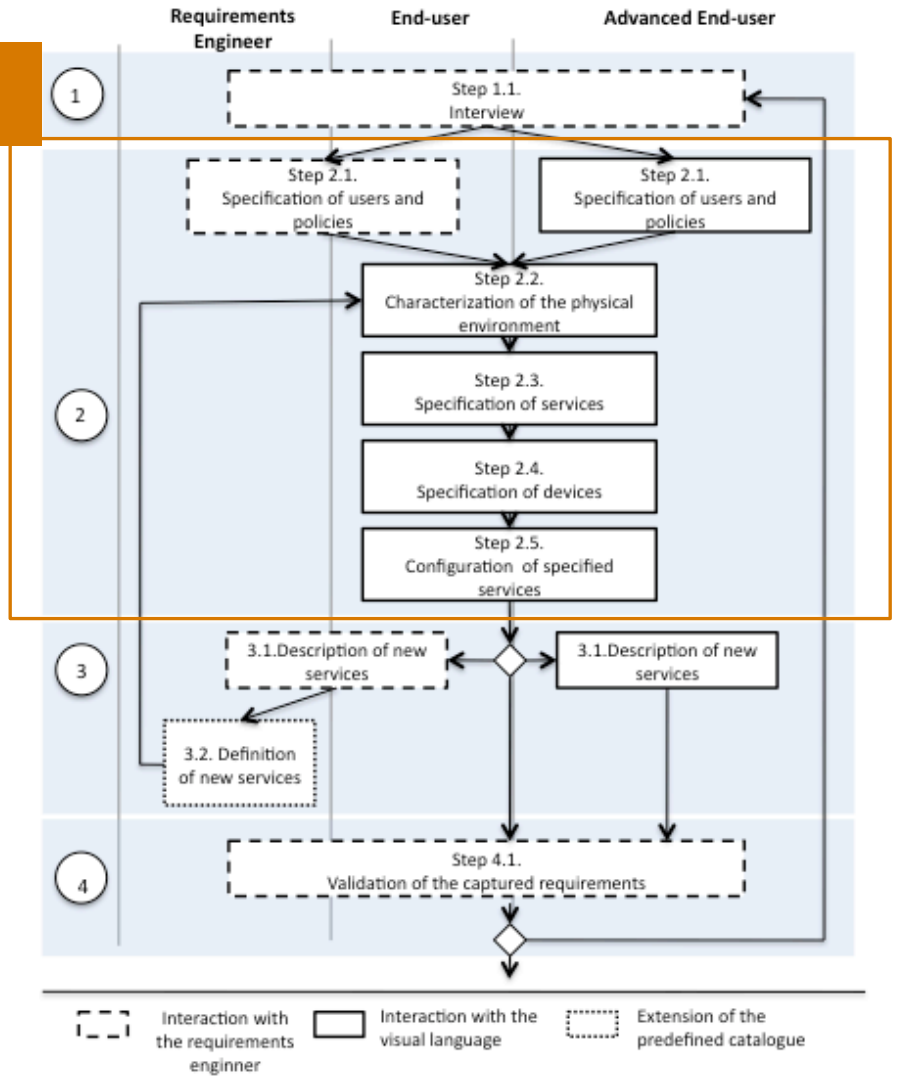
Visualization:

A) Default Configuration



B) Customized Configuration



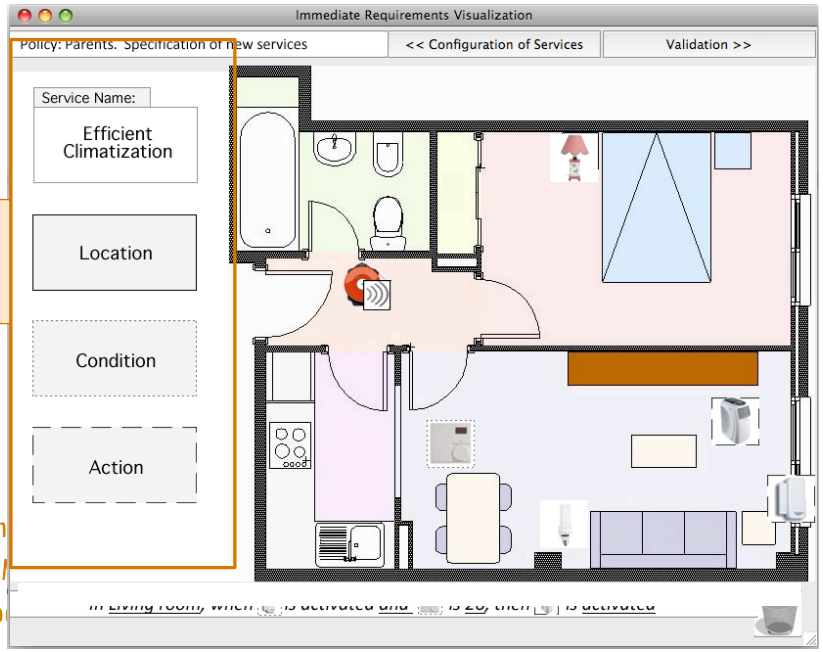


Requirements Elicitation Process

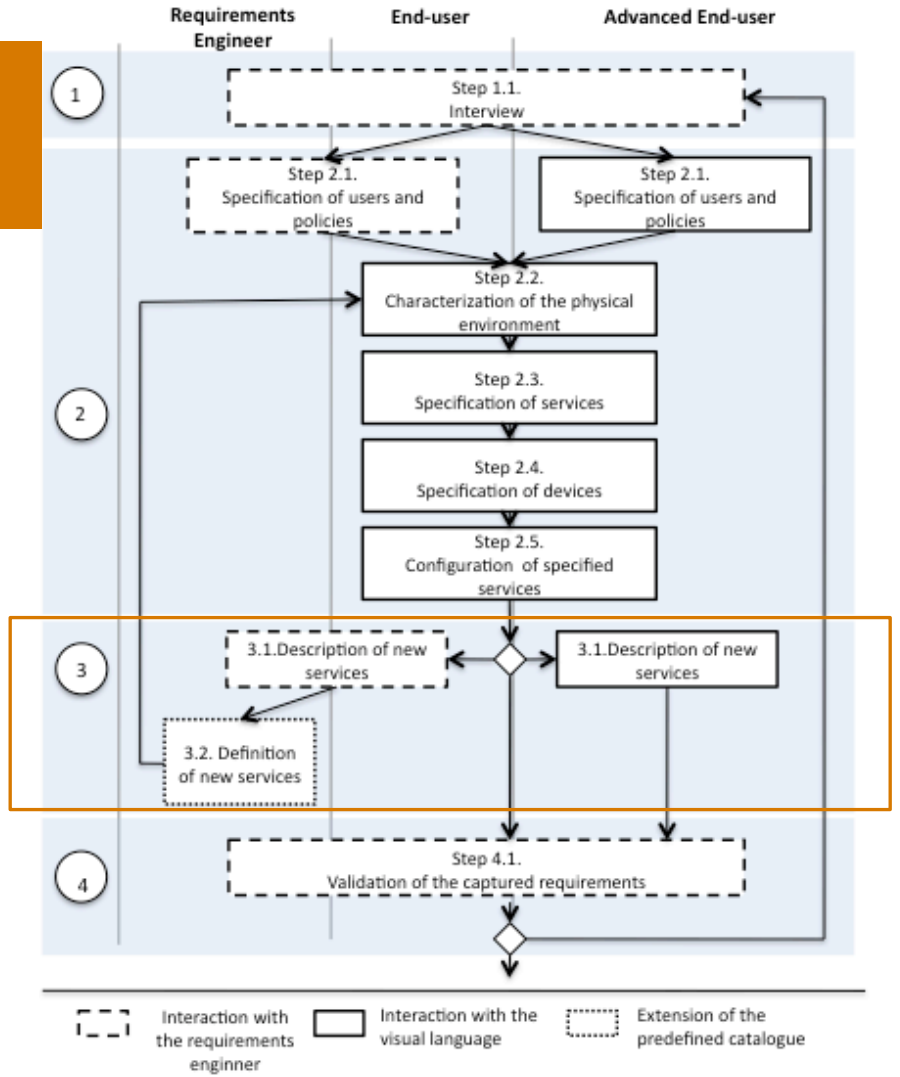
Phase 3. Advanced System configuration

- The information related to the description of new services is captured.
- End-users describe the information needed for a new service.

Visualization:



Information needed



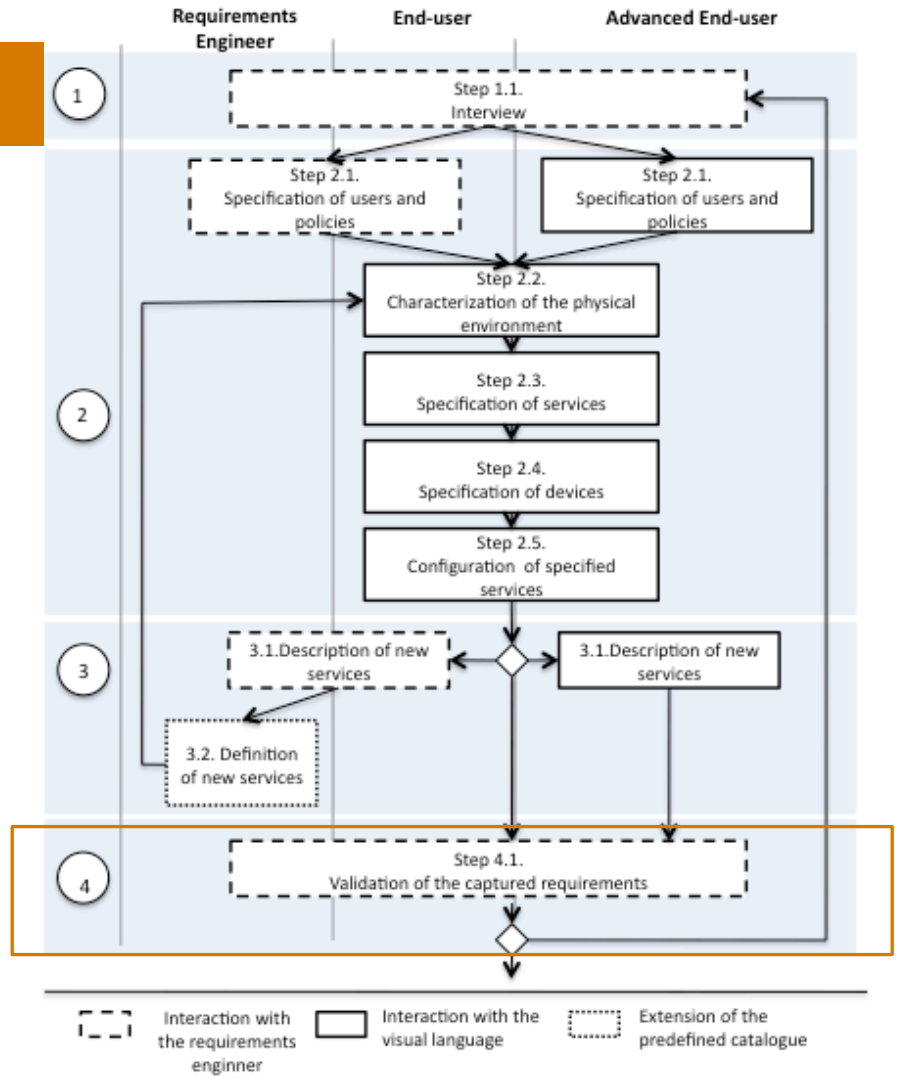
Requirements Elicitation Process

Phase 4. Validation

•Requirements engineer validates with end-users the system described. To do this, traditional interview is used.

•If ambiguities or mistakes are detected, the end-users can repeat the different phases of the process in an iterative way.

• Otherwise, the obtained **description** constitutes a valuable product that allows the requirements engineer to obtain a formal requirement specification that can be used as a guide for the rest of the development process.



Example. An end-user description

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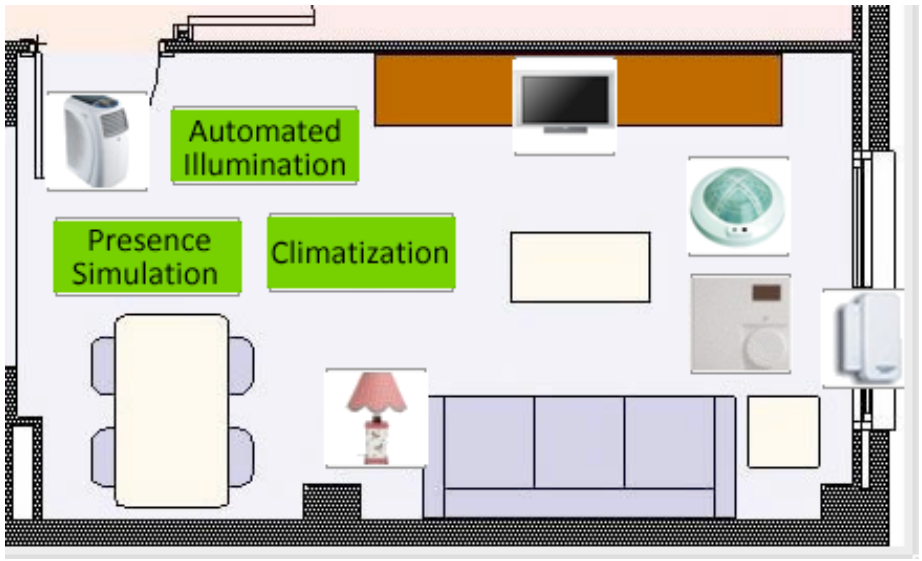
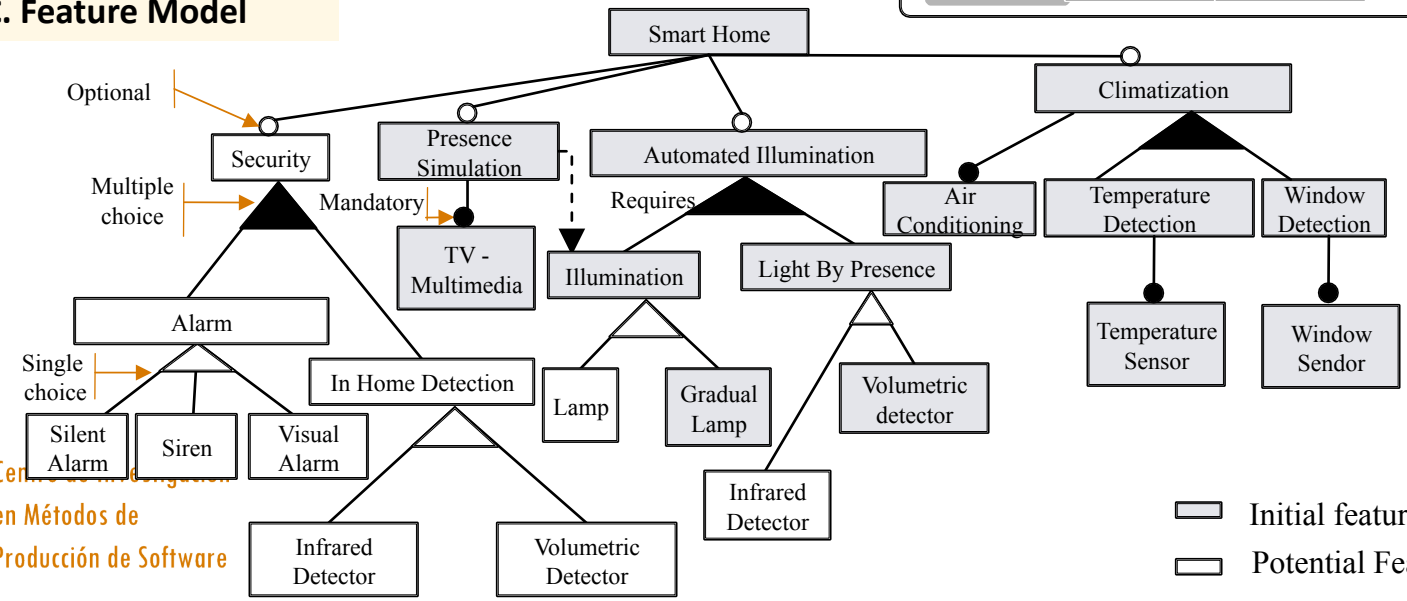
A. The Living room



B. Service Configuration

Smart Home	Autom. Illumin.	Light by presen	Volum. detector
Smart Home	Autom. Illumin.	Illum.	Gradual Lamp
Smart Home	Presen Simu.	TV-Multim	
Smart Home	Presen Simu.	Illum.	Gradual Lamp
Smart Home	Climatiz	Temp. Detect	Temp. Sensor
Smart Home	Climatiz	Window Detect	Window Sensor
Smart Home	Climatiz	Air Condit	

C. Feature Model



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Conclusions and Future work

- Our technique **involves end-users in the development process**. This improves the interaction with end-users and makes them more involved in the process.
- The use of a visualization based on the end-user environment allows requirements engineers **to mitigate the problem** that is typically known **as "clients do not really know what they want"** from early stages of the development process.
- It **avoids end-users having to extend or modify their requirements** once the development process has already started.
- By improving the understanding between end-users and software developers, the **true needs of the end-user system are addressed**.

Future work: we are working on tools that help requirements engineers automatically obtain a formal requirements specification from these descriptions.

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Thanks!

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