8-10 May, Trento (Italy)

SREP

Security Requirements Engineering Process

Speaker:

Rafael Gómez Lago
GSyA Research Group, University of Castilla La-Mancha (Spain)

Authors:

Dr. Daniel Mellado Fernández
GSyA Research Group, University of Castilla La-Mancha (Spain)

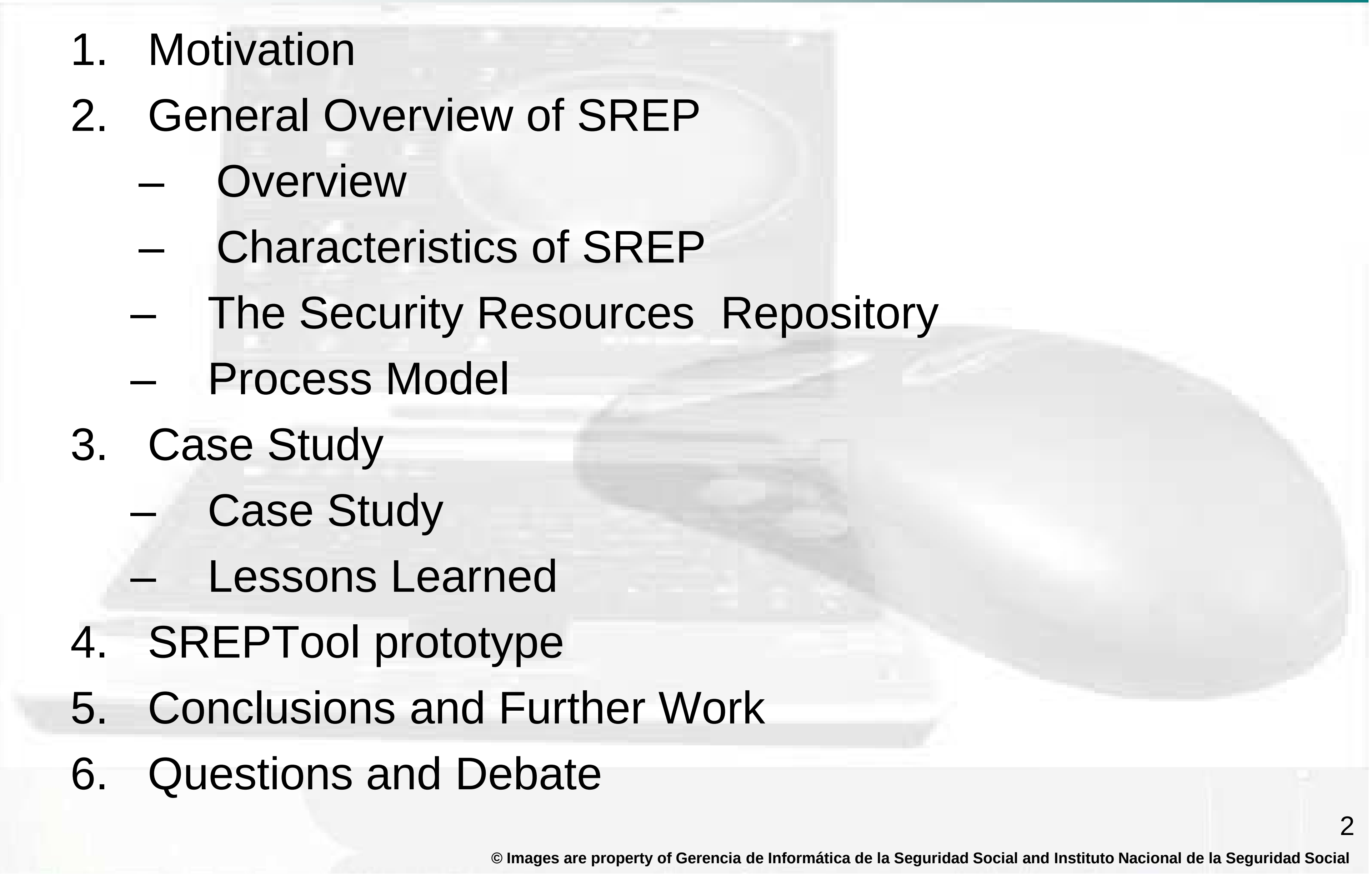
Dr. Eduardo Fernández-Medina
GSyA Research Group, University of Castilla La-Mancha

(Spain)

and

Dr. Mario Piattini
Alarcos Research Group, University of Castilla La-Mancha (Spain)

CONTENTS



1. Motivation
2. General Overview of SREP
   - Overview
   - Characteristics of SREP
   - The Security Resources Repository
   - Process Model
3. Case Study
   - Case Study
   - Lessons Learned
4. SREPTool prototype
5. Conclusions and Further Work
6. Questions and Debate

Motivation

❖Present-day information systems (IS) are vulnerable to a host of threats.

❖With increasing complexity of applications and services, there is a correspondingly greater chance of suffering from breaches in security.

❖Our Information Society, depends on a huge number of IS which have a critical role.

→**It is absolutely vital that IS are ensured as being safe right from the very beginning.**

Motivation

- It is widely-accepted that the building of security into the early stages of the development process is cost-effective and also brings about more robust designs.

☹ However, in the majority of software projects security is dealt with when the system has already been designed and put into operation.

☹ The requirements specification phase is often carried out with the aid of just a few descriptions, or the specification of objectives are put down on a few sheets of paper.

☹ Many developers tend to describe design solutions in terms of protection mechanisms.

→ **Security Requirements Engineering**

Motivation

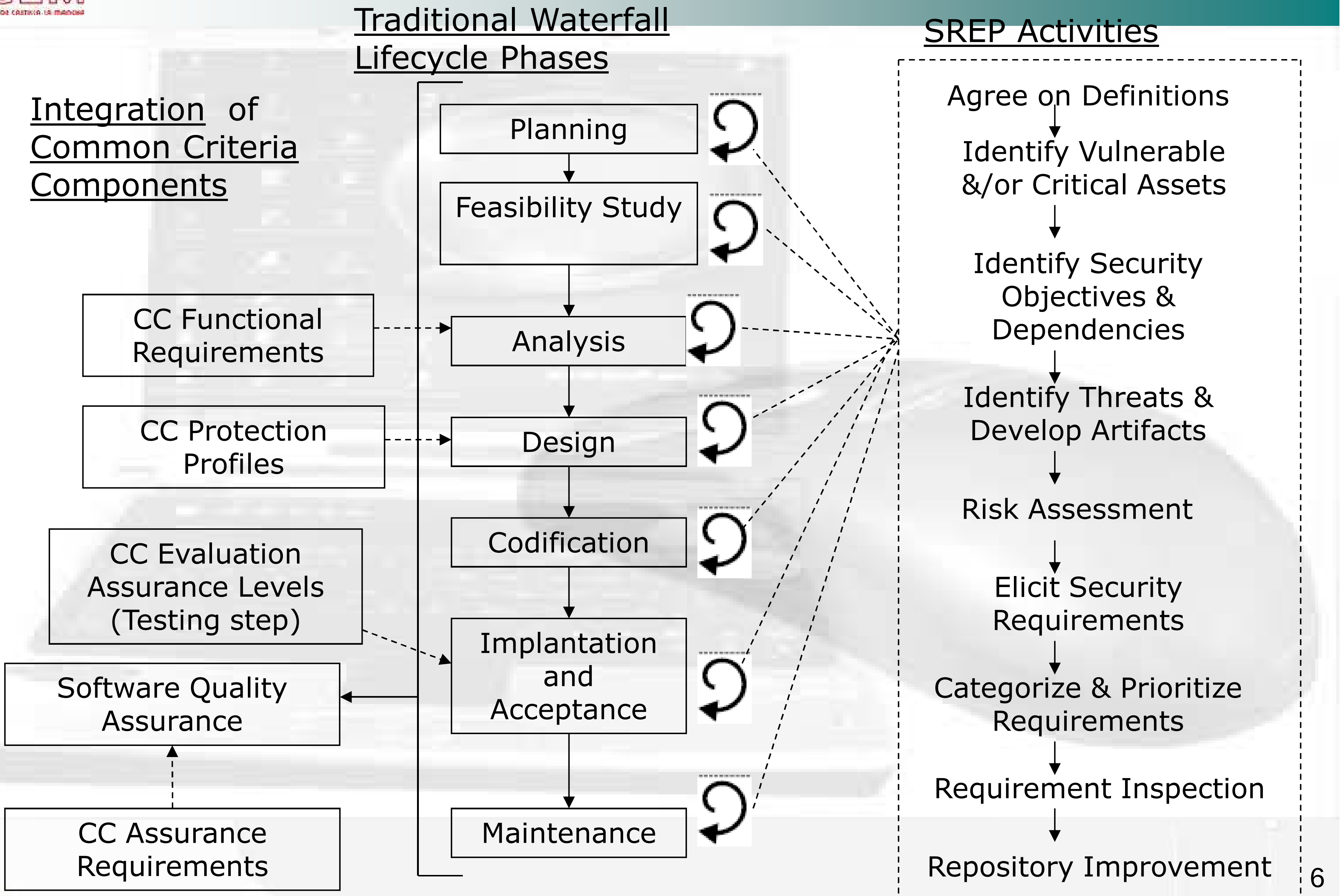
❖As it is common that security requirements are undervalued and not well understood

→Security Requirements Engineering

→It is absolutely vital that IS are ensured as being safe right from the very beginning.

SREP: deals with the security requirements at the early stages of software development in a systematic and intuitive way, it is based on the reuse of security requirements, together with the integration of the Common Criteria and the use of specific techniques within the scope of Security Requirement Engineering

A General Overview of SREP



Traditional Waterfall Lifecycle Phases

Planning

Feasibility Study

Analysis

Design

Codification

Implantation and Acceptance

Maintenance

Integration of Common Criteria Components

CC Functional Requirements

CC Protection Profiles

CC Evaluation Assurance Levels (Testing step)

Software Quality Assurance

CC Assurance Requirements

SREP Activities

Agree on Definitions

Identify Vulnerable &/or Critical Assets

Identify Security Objectives & Dependencies

Identify Threats & Develop Artifacts

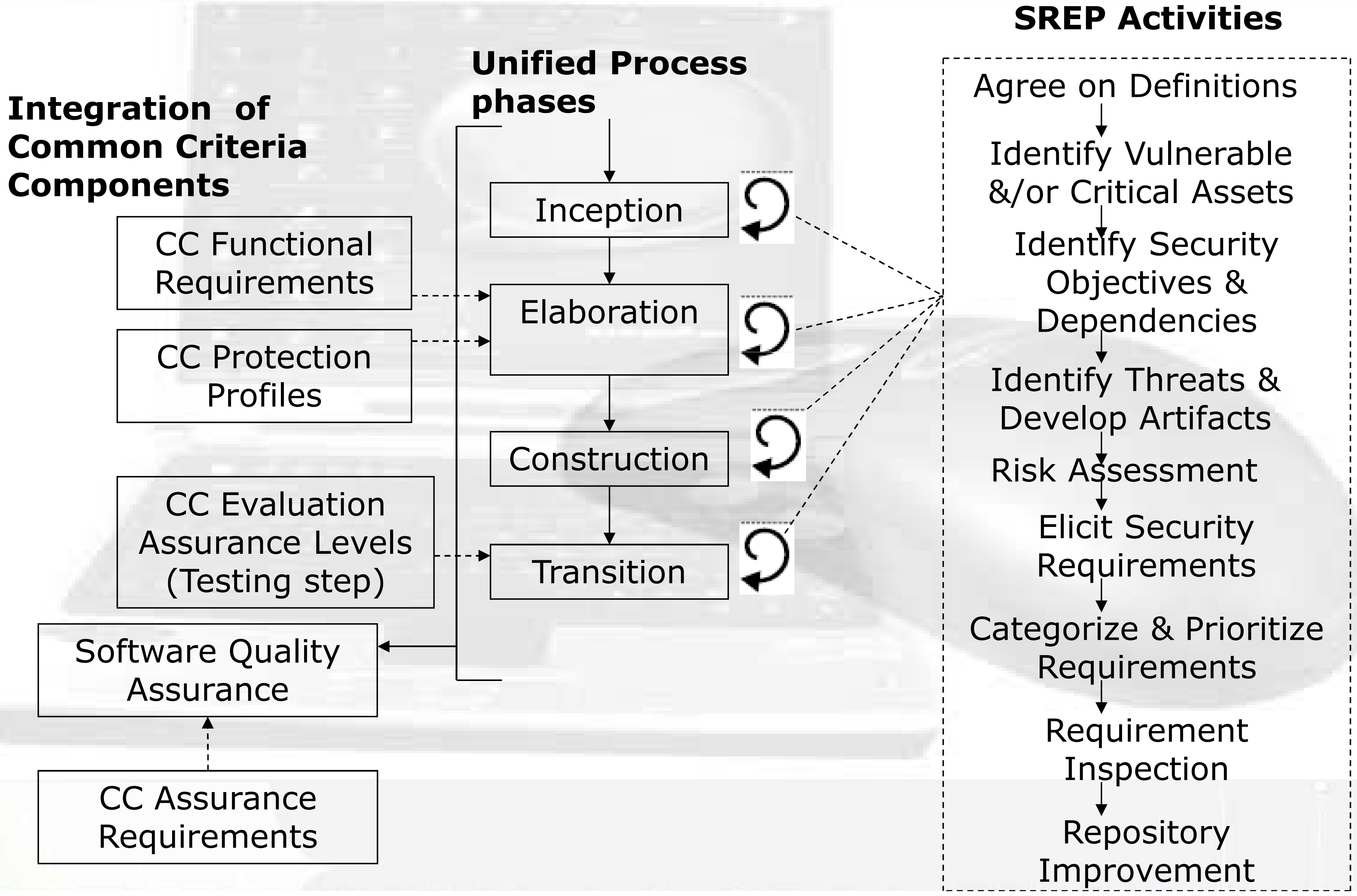
Risk Assessment

Elicit Security Requirements

Categorize & Prioritize Requirements

Requirement Inspection

Repository Improvement


Integration of Common Criteria Components

CC Functional Requirements

CC Protection Profiles

CC Evaluation Assurance Levels (Testing step)

Software Quality Assurance

CC Assurance Requirements

Unified Process phases

Inception

Elaboration

Construction

Transition

SREP Activities

Agree on Definitions

Identify Vulnerable &/or Critical Assets

Identify Security Objectives & Dependencies

Identify Threats & Develop Artifacts

Risk Assessment

Elicit Security Requirements

Categorize & Prioritize Requirements

Requirement Inspection

Repository Improvement

General Overview of SREP

- Asset-based and risk-driven.
- It describes how to integrate the CC into the software lifecycle model.
- Reuse of security requirements, assets, threats, security objectives, countermeasures → security resources repository
- The core of SREP is a micro-process, made up of nine steps which are repeatedly performed at each stage of the lifecycle.
- SQA activities where the CC Assurance Requirements might be incorporated into.

Characteristics

- Iterative and incremental
- It facilitates the reusability → a security resources repository.
- It facilitates the traceability of the security requirements.
- The focus of this methodology seeks to build security concepts at the early stages of the software development
- It supports and includes concepts and techniques within the scope of Security Requirement Engineering and Risk Management and Analysis → UMLSec, security use cases, misuse cases, threat/attack trees.
- It conforms to several standards within the scope of Requirement Engineering and Security Management → ISO/IEC 17799:2005 (current ISO/IEC 27002) and ISO/IEC 15408

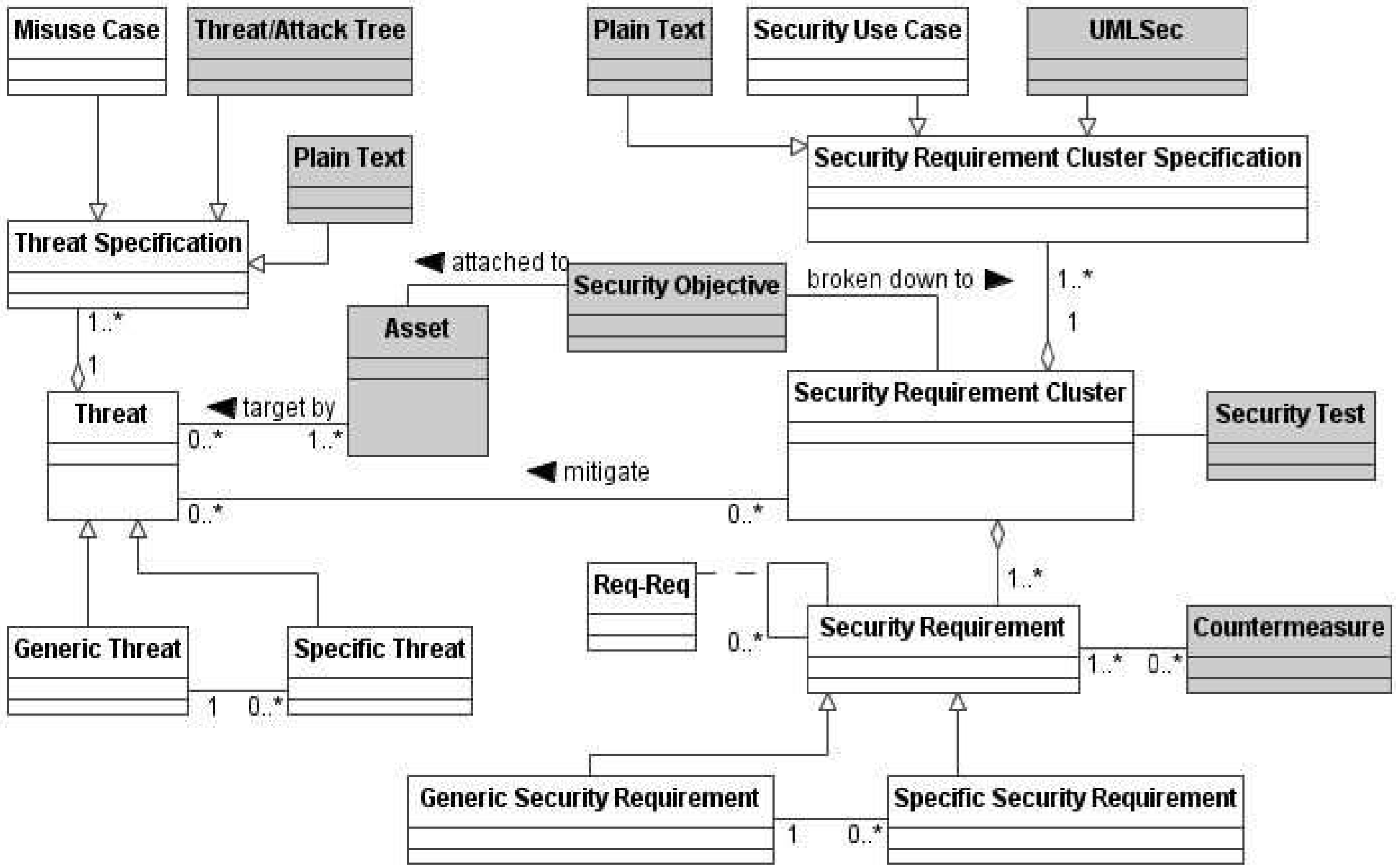
Characteristics

- **SREP Compliance with Standards.**
  - It conforms to ISO/IEC 17799:2005 (current ISO/IEC 27002) with regard to security requirements (sections: 0.3, 0.4, 0.6 and 12.1)
  - We take into account the IEEE 830-1998 standard (Requirements Inspection) →a requirement of quality has to be correct, unambiguous, complete, consistent, ranked for importance and/or stability, verifiable, modifiable, and traceable.
  - Common Criteria (ISO/IEC 15408)

Security Resources Repository

- SREP is based on several current techniques:
  - UMLSec
  - Security use cases
  - Misuse cases
- The SRR (Security Resources Repository) repository understands the concepts of domains and profiles → packages and Protection Profiles (Common Criteria)
- A meta-model, which is an extension of the meta-model for repository proposed by Sindre, G., D.G. Firesmith, and A.L. Opdahl, showing the organization of the SRR is exposed below. (The dark background in the objects represents our contribution to the meta-model)

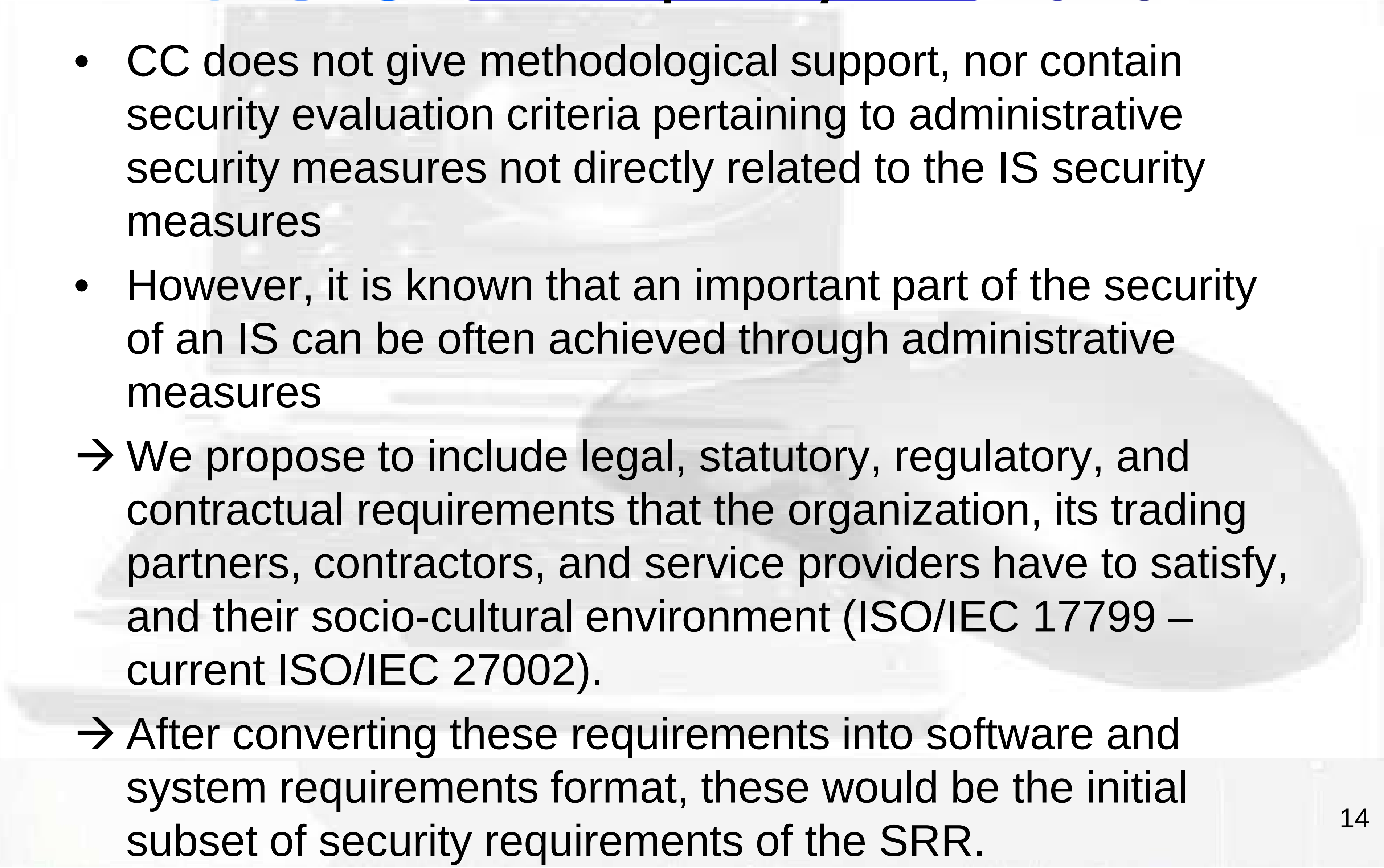
Security Resources Repository



Security Resources Repository

- ‘Generic Threat’ and ‘Generic Security Requirement’ describe independently of particular domains. And they can be represented as different specifications, thanks to the elements ‘Threat Specification’ and ‘Security Requirement Cluster Specification’.
- ‘Security Requirement Cluster’ is a set of requirements that work together in satisfying the same security objective and mitigating the same threat. We agree with Sindre, G., D.G. Firesmith, and A.L. Opdahl that, in many cases, it is a bigger and more effective unit of reuse.
- The ‘Req-Req’ relationship allows an inclusive or exclusive trace between requirements. An exclusive trace between requirements means that they are mutually alternative, as for example that they are in conflict or overlapping. Whereas, an inclusive trace between requirements means that to satisfy one, another/other/s is/are needed to be satisfied.

Security Resources Repository



- CC does not give methodological support, nor contain security evaluation criteria pertaining to administrative security measures not directly related to the IS security measures
- However, it is known that an important part of the security of an IS can be often achieved through administrative measures

→ We propose to include legal, statutory, regulatory, and contractual requirements that the organization, its trading partners, contractors, and service providers have to satisfy, and their socio-cultural environment (ISO/IEC 17799 – current ISO/IEC 27002).

→ After converting these requirements into software and system requirements format, these would be the initial subset of security requirements of the SRR.

Process Model

- *Step 1: Agree on definitions*
- *Step 2: Identify vulnerable and/or critical assets*
- *Step 3: Identify security objectives and dependencies*
- *Step 4: Identify threats and develop artefacts.*
- *Step 5: Risk assessment*
- *Step 6: Elicit security requirements*
- *Step 7: Categorize and prioritize requirements*
- *Step 8: Requirements inspections*
- *Step 9: Repository improvement*

Process Model

- At the same time, as we integrate into these nine steps the CC security functional requirements, we propose to outline the EALs in the software test plan and then verify them during test execution.

- And parallely, we proposed to introduce the CC security assurance requirements into SQA activities, like quality control, defect prevention and defect removal activities. →the configuration management plan is the first activity that is explicitly required to fulfil the CC security assurance requirements

Process Model

- ***Activity 1: Agree on definitions***. The first task for the organization is to define the stakeholders and to agree upon a common set of security definitions, along with the definition of the organizational security policies and the security vision of the IS. It is in this activity when the *Vision Document* artefact is created and it must contain the general vision of the IS with a special focus on security aspects. In addition the stakeholders will participate in these latter tasks, and the candidate definitions will be mainly taken from ISO/IEC and IEEE standards, such as ISO/IEC 13335, ISO/IEC 17799:2005 (current 27002), ISO/IEC 27001:2005, ISO/IEC 9126, IEEE Std. 830:1998, or IEEE Std. 1061-1992

- ***Activity 2: Identify vulnerable and/or critical assets***. This is where the SRR is used for the first time. It consists of the identification of the different kinds of valuable or critical assets as well as vulnerable assets by the requirements engineer, who can be helped by using:
  - Lists of assets of the SRR, where the assets can be searched by domains, even it can be selected a similar profile.
  - Functional requirements.
  - Interviews with stakeholders.

Process Model

- ***Activity 3: Identify security objectives and dependencies***. In this activity the SRR can be also used. Otherwise we will take into account the security policy of the Organization as well as legal requirements and other constraints in order to determine the security objectives. For each asset identified in the previous activity, the appropriate security objectives for the asset are selected and the dependencies between them are identified. Moreover the security objectives for the environment are retrieved and the assumptions about the environment are made in this activity. Security objectives are expressed by specifying the necessary security level as a probability, and they are also specified in terms of likely attacker types. The *Security Objectives Document* is developed in this activity and it may be refined in subsequent iterations (within the Inception and Elaboration phases).

Process Model

- ***Activity 4: Identify threats and develop artifacts***. Each asset is targeted by threat/s that can prevent the security objective from being achieved. First of all, it is necessary to find all the threats that target these assets with the help of the SRR. In addition, it could be necessary to develop artifacts (such as *misuse cases* or *attack trees diagrams* or *UMLSec use cases* and *classes* or *sequence/state diagrams*) to develop new specific or generic threats or requirements. Also it is necessary to look for threats that are not linked/related to the assets of the repository, therefore according to CC assurance requirements we could search in public domain sources to identify potential vulnerabilities in the IS, or we could instantiate the business use cases into misuse cases or instantiate the threat-attack trees associated to the business and application pattern. At this point it may be possible to take one or several existing *Protection Profiles* or *packages* and adapt them to meet modified requirements. Finally, it is also defined the security problem and the conformance claims, thereby it is generated the *Security Problem Definition Document* which must contain the threats, assumptions, and conformance claims. In addition, this document may be refined in subsequent iterations.

Process Model

- ***Activity 5: Risk assessment*****.** Risk must be normally determined from application to application. The final goal to achieve is the 100% risk acceptance. Firstly, it is necessary to assess whether the threats are relevant according to the security level specified by the security objectives. Then we have to estimate the security risks based on the relevant threats, their likelihood and their potential negative impacts. All of this is captured in the *Risk Assessment Document*, which is refined in subsequent iterations (within the Inception and Elaboration phases). Several methodologies can be used to carry out the risk assessment. The ISO/IEC 13335 (GMITS), provides guidance on the use of the risk management process. In Spain it might be used MAGERIT (the Spanish public administration risk analysis and management method) or CRAMM (CCTA Risk Analysis and Management Method) in the UK. Thereby, this assessment allows us to discover how the organization’s risk tolerance is affected with regard to each threat. The stakeholders will take part in this activity.

Process Model

- ***Activity 6: Elicit security requirements***. Here, the SRR is used again. For each threat retrieved from the repository, one or more associated clusters of security requirements may be found. The suitable security requirements or the suitable cluster of security requirements that mitigate the threats at the necessary levels with regard to the risk assessment must be selected. However, additional requirements or clusters of requirements may be found by other means. Moreover, it might be specified the security test for each security requirement cluster, as well as an outline of the countermeasures for each security requirement, although they are refined at the design stage. Nevertheless, we agree with Firesmith in the fact that care should be taken to avoid unnecessarily and prematurely architectural mechanisms specification. Thus, at the end of this activity and according to ISO/IEC 17799:2005 (current ISO/IEC 27002) it must have been specified the functional, assurance, and organizational security requirements, along with the security requirements for the IT development and operational environment. Thereby, the *Security Requirements Specification Document* is created and refined in subsequent iterations

- ***Activity 7: Categorize and prioritize requirements***. Each requirement is categorized and prioritized in a qualitative ranking in a way that the most important requirements (in terms of impact and likelihood) are handled first.

Process Model

- ***Activity 8: Requirements inspection*.** Requirements inspection is carried out in order to validate all the generated artifacts (all the documents, requirements, the modified model elements and the new generated model elements) and it is generated a *Validation Report*. Its aim is to review the quality of the team's work and deliverables as well as assesses the security requirements engineering process. So, it is used as a sanity check. Moreover, it is verified whether the security requirements conform to the IEEE 830-1998 standard, because according to this standard, a requirement of quality has to be correct, unambiguous, complete, consistent, ranked for importance and/or stability, verifiable, modifiable, and traceable. After all, the security requirements documentation is written, so that a *Security Requirements Rationale Document* is provided, showing that if all the security organizational, functional and assurance requirements are satisfied and all security objectives are achieved, the defined security problem is solved: all the threats are countered, the organizational security policies are enforced and all assumptions are upheld. Furthermore, it is performed within the Test workflow of the UP and with the help of the CC assurance requirements and EALs (Evaluation Assurance Level) and the SSE-CMM (ISO/IEC 21827). Thereby, we propose to evaluate the security of the IS along with the security engineering process by using the CC assurance requirements and the SSE-CMM at the same time with the help of CC_SSE-CMM . Thus referring to CC_SSE-CMM Part 3, the Process Area (PA) in association with CC EAL can be selected and based on the PA selected it can be determined the current level of SSE-CMM operation capability and extract the path for the better operation capability level . Thus, it can be assured that a security IS with a high reliability will be developed by conducting the CC evaluation and the SSE-CMM evaluation at the same time. Additionally, this activity is carried out by the quality assurer and by the inspection team at the last phase (Transition phase), with the participation of the stakeholders and security requirements engineers mainly

Process Model

- ***Activity 9: Repository improvement***. The new model elements (threats, requirements, etc…) found throughout the development of the previous activities and which are considered as likely to be used in forthcoming applications and with enough quality, according to the Validation Report, are introduced into the SRR. Furthermore, the model elements already in the repository could be modified in order to improve their quality. Thereby, all these new or modified model elements / artifacts, which have been introduced into the SRR, altogether constitute a baseline. After that the *Security Target* or *Protection Profile documents* of the CC are written. This activity will be performed coinciding with the milestone at the end of each phase of the UP.

SREP - Roles

X, has responsibility *, supports O, does not participate	Business modeller	Security requirement engineer	Risk expert	Security expert	Security developer	Quality assurer	Inspection team
Agree on definitions	*	X	O	*	O	*	O
Identify vulnerable and/or critical assets	*	X	O	*	O	*	O
Identify security objectives and dependencies	*	X	O	*	O	*	O
Identify threats and develop artifacts	*	X	O	*	*	*	O
Risk assessment	O	O	X	*	O	O	O
Elicit security requirements	O	X	*	*	O	*	O
Categorize and prioritize requirements	*	X	O	*	O	*	O
Requirements inspection	*	*	*	*	*	X	X
Repository improvement	O	X	O	*	O	*	O

SREP - Roles

→ These roles are a supplement to the roles in software engineering, but are especially focused on security and also require special training

- ***Business modeller***. He/she describes the business processes, the roles involved and the artifacts produced or used in the process. He/she helps develop artifacts in SREP (like misuse cases, etc.) and construct the processes in a security-enhanced way, which fit in the business model of the IS.
- ***Security requirement engineer***. This is the key role and it participates and leads most activities. It is in charge of the security vision of the IS, it also identifies the assets, the security objectives and its dependencies and the threats, and elicits and specifies the requirements, as well as categorizes and prioritizes the requirements with the help of other kind of specialists (if needed). Depending on the size of the project more than one person can be assigned to this role. Furthermore, this role must not necessarily have a thorough technical understanding of security, although a sound security management is required.

SREP - Roles

- ***Security expert***. The main task of the security expert is to improve the overall security of the IS. This role is the technical expert in security so that he/she acts as a consultant, and helps us find security relevant information, estimate the degree to which IS meets its security claims and define the security vision of the IS and the organizational security policies and measures.
- ***Security developer***. The role of the security developer is to support the construction of tests to help the Requirements Inspection activity during the Test workflow of the UP.

SREP - Roles

- ***Quality assurer***. This is the role responsible for the Requirements Inspection activity within the Test workflow of the UP and it could take advantage of the use of the CC assurance classes. In addition, this role can help us with informal reviews of the quality of the most important artifacts in each activity.
- ***Inspection team***. It is a group external to the IS development team whose aim is to review the quality of the development team's work and deliverables as well as evaluate the security engineering process by using the CC assurance requirements and the SSE-CMM, with the help of CC_SSE-CMM [12]. Besides it is the role responsible for the Requirements Inspection activity within the Transition phase of the UP. Additionally, this team is in charge of the assurance that the IS meets its security claims with the help of the EALs.

Process Model

- **Iterations**

  The integration of SREP, with the CC and with the phases of the UP is presented below:

- ***Inception***. It is the first phase and it is focused on the earlier activities of SREP. The security vision document is produced, and around the 50% of the first order requirements are defined, therefore a similar percentage of the assets, security objectives and threats. In addition, the security problem definition is carried out and an overall risk outline is performed. Moreover, the main focus with regard to the CC assurance classes is on the following classes: Composition, Lifecycle Support and Vulnerability Assessment. Also, at this point, it may be possible to take an existing or several Protection Profiles or packages and adapt them to meet modified requirements. Nevertheless, it is difficult to conduct everything in one iteration, so it might be necessary another iteration with more mature understanding of the IS.

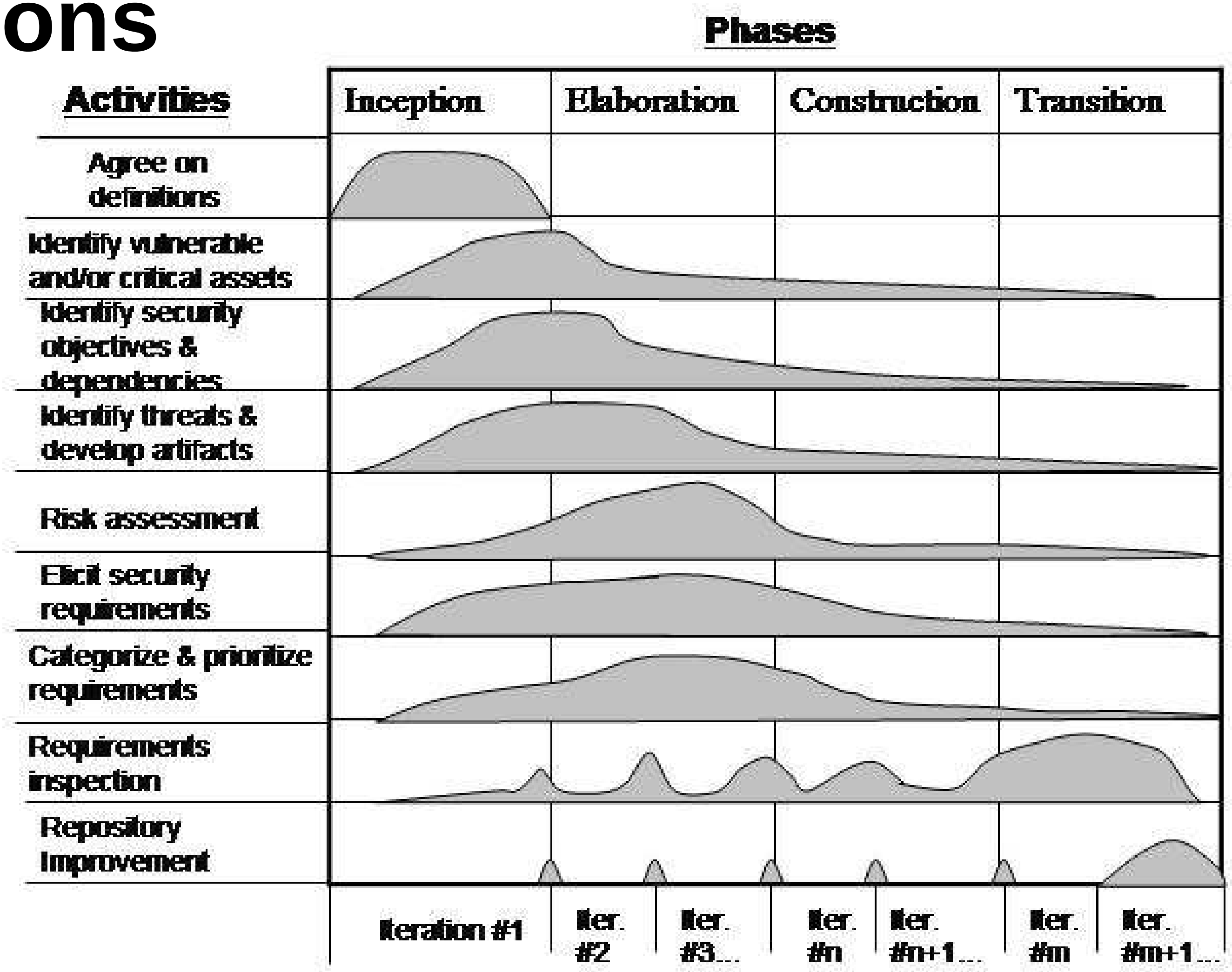
Process Model

- ***Elaboration***. More than one iteration may be normally made at this phase depending on the size and complexity of the project. The goal of this phase, and according to ISO/IEC 17799:2005, is to identify around 98% of the critical/vulnerable assets, security objectives, threats and first ordered requirements and around 90% of second ordered requirements. Moreover a refinement of the risk assessment and the security problem definition is carried out. In addition, this phase is also focused on the requirements categorization and prioritization, and on the requirements inspection as well as on the security requirements rationale. Therefore, the most important CC assurance classes for this phase are: Security Target Evaluation, Protection Profile Evaluation, Guidance Documents, Development, and Vulnerability Assessment.

- **Construction**. At this phase, the remaining requirements are defined along with the final design and the implementation of the security countermeasures. The Requirements Inspection activity is emphasized at this phase. The main focus with regard to the CC assurance classes is on the following classes: Security Target or PP Evaluation, Development, Composition and Vulnerability Assessment.

- **Transition**. It is the last phase and when the IS is put into productive use. The danger is, however, that other requirements can emerge, thus security risks must be considered and therefore they must be dealt with carefully and in a pragmatic way. This phase is focused on the Requirements Inspection and Repository Improvement activities. So, the most important CC assurance classes for this phase are: Security Target or PP Evaluation, Tests, Guidance Documents, Composition, and Vulnerability Assessment

Iterations



Phases

Activities

Inception

Elaboration

Construction

Transition

Agree on definitions

Identify vulnerable and/or critical assets

Identify security objectives & dependencies

Identify threats & develop artifacts

Risk assessment

Elicit security requirements

Categorize & prioritize requirements

Requirements inspection

Repository Improvement

Iteration #1

Iter. #2

Iter. #3...

Iter. #n

Iter. #n+1...

Iter. #m

Iter. #m+1...

Case Study

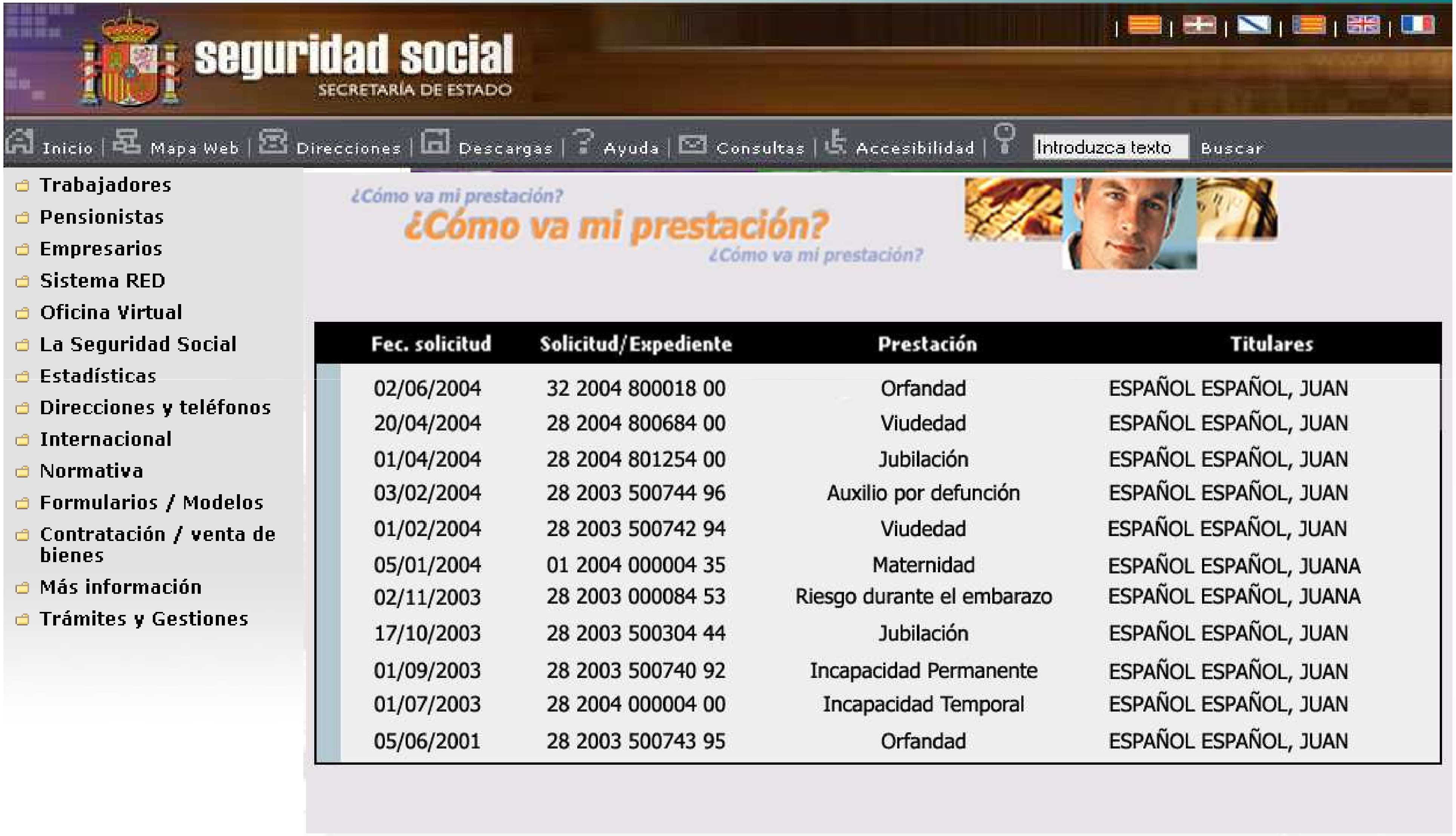
SECRETARIA DE ESTADO
DE LA SEGURIDAD SOCIAL

INSTITUTO NACIONAL DE LA
SEGURIDAD SOCIAL

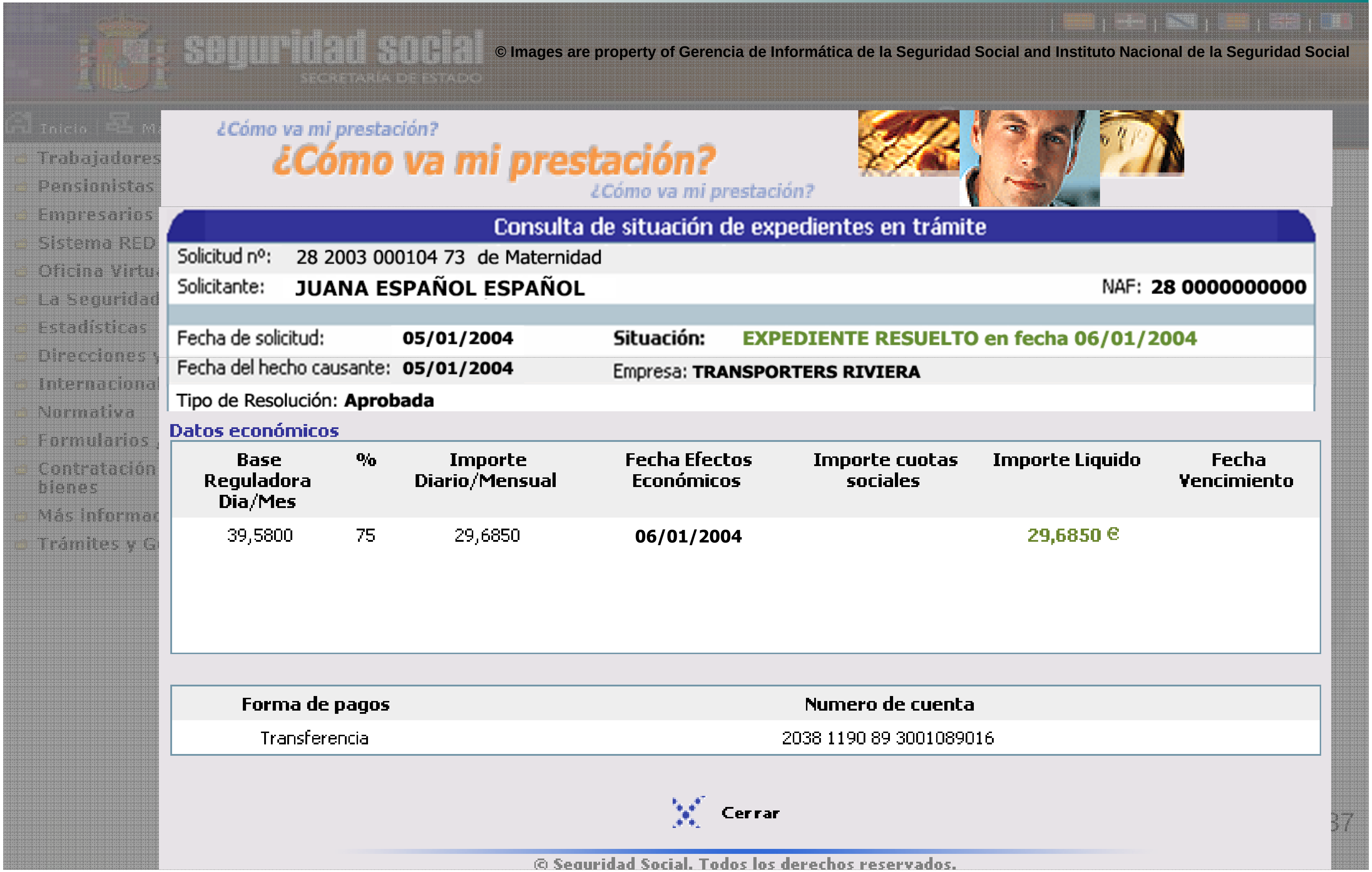
- Case study of an application of the National Social Security Institute (of Spain) :

- Initial functional requirements :
  - *Req 1*: On request-1 from an EndUser, the system shall display information about his/her pension/s. This request shall include the social security number of the EndUser.
  - *Req 2*: On request-2 from an EndUser, the system shall update the personal information of the pensioner. This request shall include the social security number of the EndUser and changed personal data.

Case Study



Fec. solicitud	Solicitud/Expediente	Prestación	Titulares
02/06/2004	32 2004 800018 00	Orfandad	ESPAÑOL ESPAÑOL, JUAN
20/04/2004	28 2004 800684 00	Viudedad	ESPAÑOL ESPAÑOL, JUAN
01/04/2004	28 2004 801254 00	Jubilación	ESPAÑOL ESPAÑOL, JUAN
03/02/2004	28 2003 500744 96	Auxilio por defunción	ESPAÑOL ESPAÑOL, JUAN
01/02/2004	28 2003 500742 94	Viudedad	ESPAÑOL ESPAÑOL, JUAN
05/01/2004	01 2004 000004 35	Maternidad	ESPAÑOL ESPAÑOL, JUANA
02/11/2003	28 2003 000084 53	Riesgo durante el embarazo	ESPAÑOL ESPAÑOL, JUANA
17/10/2003	28 2003 500304 44	Jubilación	ESPAÑOL ESPAÑOL, JUAN
01/09/2003	28 2003 500740 92	Incapacidad Permanente	ESPAÑOL ESPAÑOL, JUAN
01/07/2003	28 2004 000004 00	Incapacidad Temporal	ESPAÑOL ESPAÑOL, JUAN
05/06/2001	28 2003 500743 95	Orfandad	ESPAÑOL ESPAÑOL, JUAN



© Images are property of Gerencia de Informática de la Seguridad Social and Instituto Nacional de la Seguridad Social

Consulta de situación de expedientes en trámite

Solicitud nº: 28 2003 000104 73 de Maternidad

Solicitante: **JUANA ESPAÑOL ESPAÑOL** NAF: **28 0000000000**

Fecha de solicitud: **05/01/2004** **Situación:** **EXPEDIENTE RESUELTO en fecha 06/01/2004**

Fecha del hecho causante: **05/01/2004** Empresa: **TRANSPORTERS RIVIERA**

Tipo de Resolución: **Aprobada**

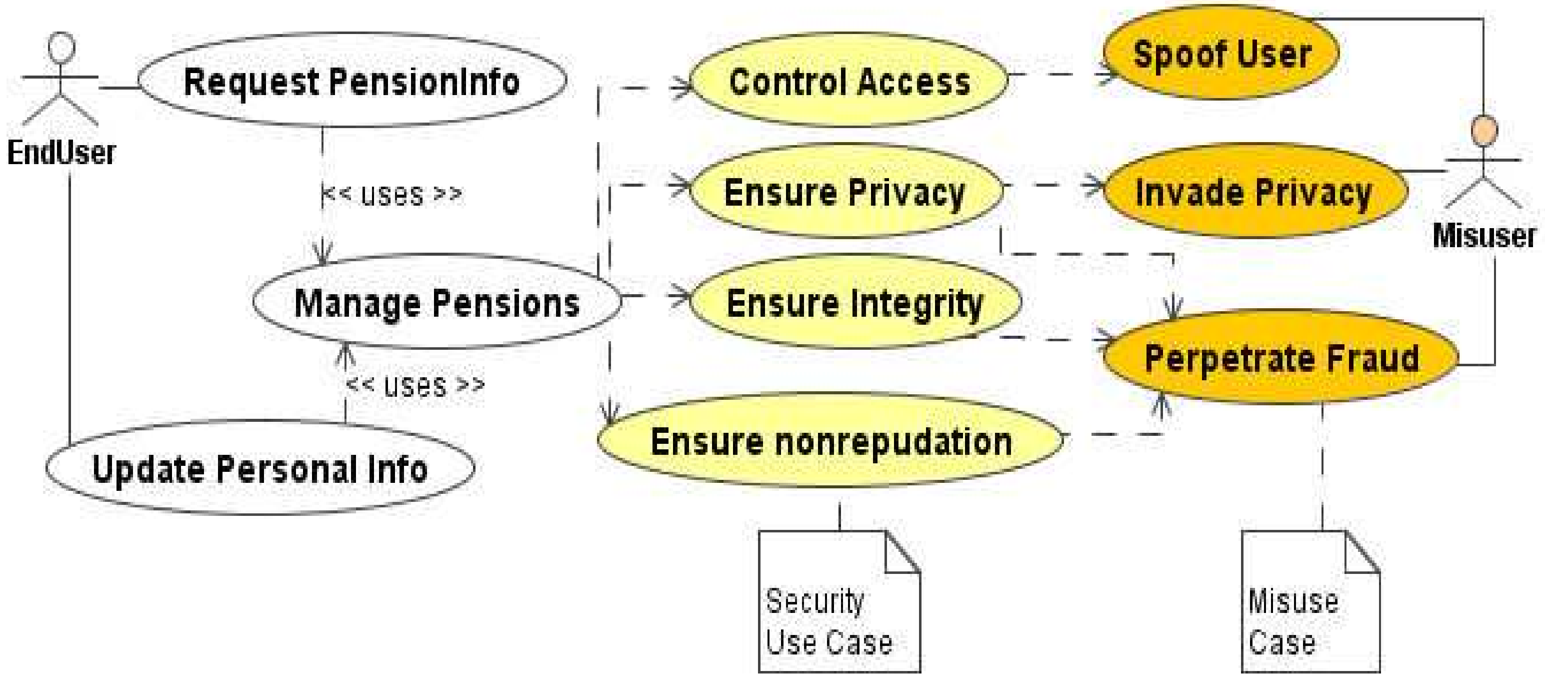
Datos económicos

Base Reguladora Dia/Mes	%	Importe Diario/Mensual	Fecha Efectos Económicos	Importe cuotas sociales	Importe Liquido	Fecha Vencimiento
39,5800	75	29,6850	**06/01/2004**		29,6850 €	

Forma de pagos	Numero de cuenta
Transferencia	2038 1190 89 3001089016

- Activity 1: Agree on definitions
- Activity 2: Identify vulnerable and/or critical assets
  - Personal information: kind of pension (old-age / disability (type of disability) / widow’s pension.), amount of money, bank account number .
- Activity 3: Identify security objectives and dependencies
  - SO1: Prevent unauthorised disclosure of information. (Confidentiality). Valuation – High.
  - SO2: Prevent unauthorised alteration of information. (Integrity). Valuation – High.
  - SO3: Ensure availability of information to the authorised users. Valuation – Medium.
  - SO4: Ensure authenticity of users. Valuation – High.
  - SO5: Ensure accountability. Valuation – Medium

- Activity 4: Identify threats and develop artifacts
  - Generic Threat 1: Unauthorised disclosure of information.
  - Generic Threat 2: Unauthorised alteration of information.
  - Generic Threat 3: Unauthorised unavailability to information.
  - Generic Threat 4: Spoof user.



Nombre del Caso de Uso de Seguridad Genérico:				
ID: CUSG-2-2-1-RS3-1 (es el primer CUSG asociado con CMUG-1-1-1) [CUSG-Objetivo Seguridad –Amenaza Generica- Iteración- Requisitos de Seguridad- Caso de Uso de Seguridad Genérico]				
Precondiciones: 1) El atacante [tipo atacante] [nombre atacante] tiene acceso fisicamente al mensaje. 2) El atacante [tipo atacante] [nombre atacante] tiene claros conocimientos sobre la estructura y significado del mensaje				
Interacciones del Mal Usuario	**Requisitos del Sistema**			
	Interacciones del Agente del Usuario	**Acciones del Agente del Usuario**	**Interacciones del Sistema**	**Acciones del Sistema**
	El Agente Usuario [nombre agente] construye un mensaje http privado [nombre-mensaje] y se lo envía al Sistema	El Agente Usuario [nombre agente] debería garantizar que si ocurriese alguna alteración del mensaje [nombre mensaje] en el camino, fuera detectado fácilmente por el Sistema		
El atacante [tipo atacante] [nombre atacante] lo intercepta e identifica la parte del mensaje y lo modifica y [borra | cambia | añade] información y lo reenvía al Agente del Sistema				
			El Agente del Sistema recibe el mensaje alterado [nombre mensaje]	El Agente del Sistema detecta que el mensaje [nombre mensaje] fue alterado en el camino y lo rechaza y ejecuta [operaciones]
Poscondiciones: 1) El Agente del Sistema habrá ejecutado [operaciones] [nombre del agente] con el objetivo de detectar que el mensaje ha sido alterado en el camino.				

Case Study

- Activity 5: Risk assessment
  - MAGERIT v.2

Table of Threats, attacks and risks - Iteration 1				
Threat	Impact	Attack	Probability	Risk
1.2.1.1.1.1 Alteration of the information	LOW, if there is not pension information modified	*SMUC-2-2-1-1-1*	HIGH	**LOW**
	HIGH if the opposite is the case.	*SMUC-2-2-1-1-1*	HIGH	**HIGH**

- Activity 6: Elicit security requirements
  - SR1 a SR6 (security use cases)

Case Study

- **SR1**: The security functions of PensionApp shall **use *cryptography*** [assignment: *cryptographic algorithm* and *key sizes*] to protect confidentiality of pension information provided by PensionApp to an EndUser. (CC requirement FCO_CED.1.1)
- **SR2**: The security functions of PensionApp shall **identify and authenticate an EndUser by using *credentials*** [assignment: *challenge-response technique based on exchange of encrypted random nonces, public key certificate*] before an EndUser can bind to the shell of PensionApp. (CC requirements FIA_UID.2.1 & FIA_UAU.1.1)
- **SR3**: When PensionApp transmits pension or pensioner's information to EndUser, the security functions of PensionApp shall provide that user with the ***means*** [assignment: *digital signature*] to **detect** [selection: *modification, deletion, insertion, replay, other integrity*] **anomalies**. (CC requirement FCO_IED.1.1)
- **SR4**: The security functions of PensionApp shall **ensure the availability** of the information provided by PensionApp to an EndUser within [assignment: *a defined availability metric*] given the following conditions [assignment: *conditions to ensure availability*]. (CC requirement FCO_AED.1.1)
- **SR5**: The security functions of PensionApp shall require **evidence** that PensionApp has pension **information** to an EndUser and he/she has **received** the information. (CC requirement FCO_NRE.1.1)
- **SR6**: The security functions of PensionApp shall store an **audit record** of the following events [selection: *the request for pension information, the response of PensionApp*] and each audit record shall record the following information: date and time of the event, [selection: *success, failure*] of the event, and EndUser identity. (CC requirements FAU_GEN)

- Activity 7: Categorize and prioritize requirements
- Activity 8: Requirements inspection
- Activity 9: Repository improvement

Lessons Learned

- To improve and refine the some activities of SREP
- Iterative e incremental → facilitates reuse and correct errors, risks are discovered and mitigated earlier, and the process itself can be improved and refined along the way.
- CC does not provide us with any method/guide to include them into the software development process, so that a modification in one document often leads to modify several other documents
- Tool support is critical for the practical application of this process in large-scale software systems due to the number of handled artifacts and the several iterations that have to be carried out

SREPTool - prototype

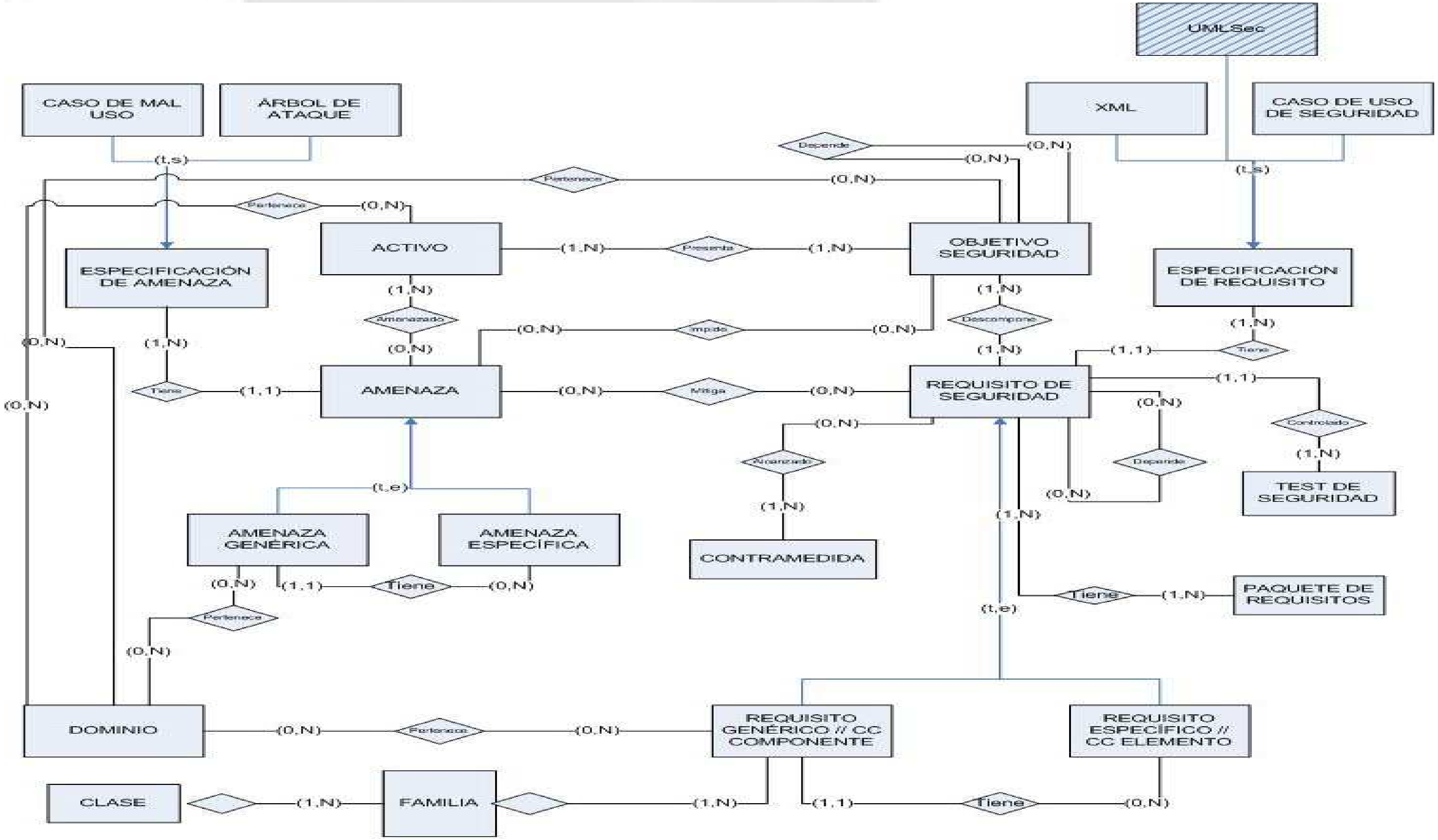
- Characteristics
- Da soporte a SREP→ soporte sistemático e intuitivo
- Facilita el desarrollo iterativo e incremental.
- Facilita la reutilización → Repositorio de recursos de seguridad
- Facilita la trazabilidad de requisitos de seguridad y con los otros requisitos funcionales y no funcionales → se integra con RequisitePro.
- El fin que busca es construir conceptos de seguridad en las primeras fases del desarrollo software.
- Soporta e incluye conceptos y técnicas dentro del campo de la Ingeniería de Requisitos de Seguridad y del Análisis y Gestión de Riesgos → casos de uso de seguridad, casos de mal uso…
- Facilita la ejecución del Proceso Unificado (RUP) y también complementa a MÉTRICA v.3 y su interfaz de seguridad con MAGERIT v.2.
- Es conforme e integra algunos de los estándares más importantes para el tratamiento de requisitos de seguridad y facilita que los SI desarrollados sean conformes a éstos: ISO/IEC 15408, ISO/IEC 17799, ISO/IEC 27001, IEEE 830: 1998.
- Technology: Visual Basic; *RequisitePro Extensibility Server* (RPX); *RqGUIApp library; MS-Access;*

❖ Requirements Tools Comparision for extension

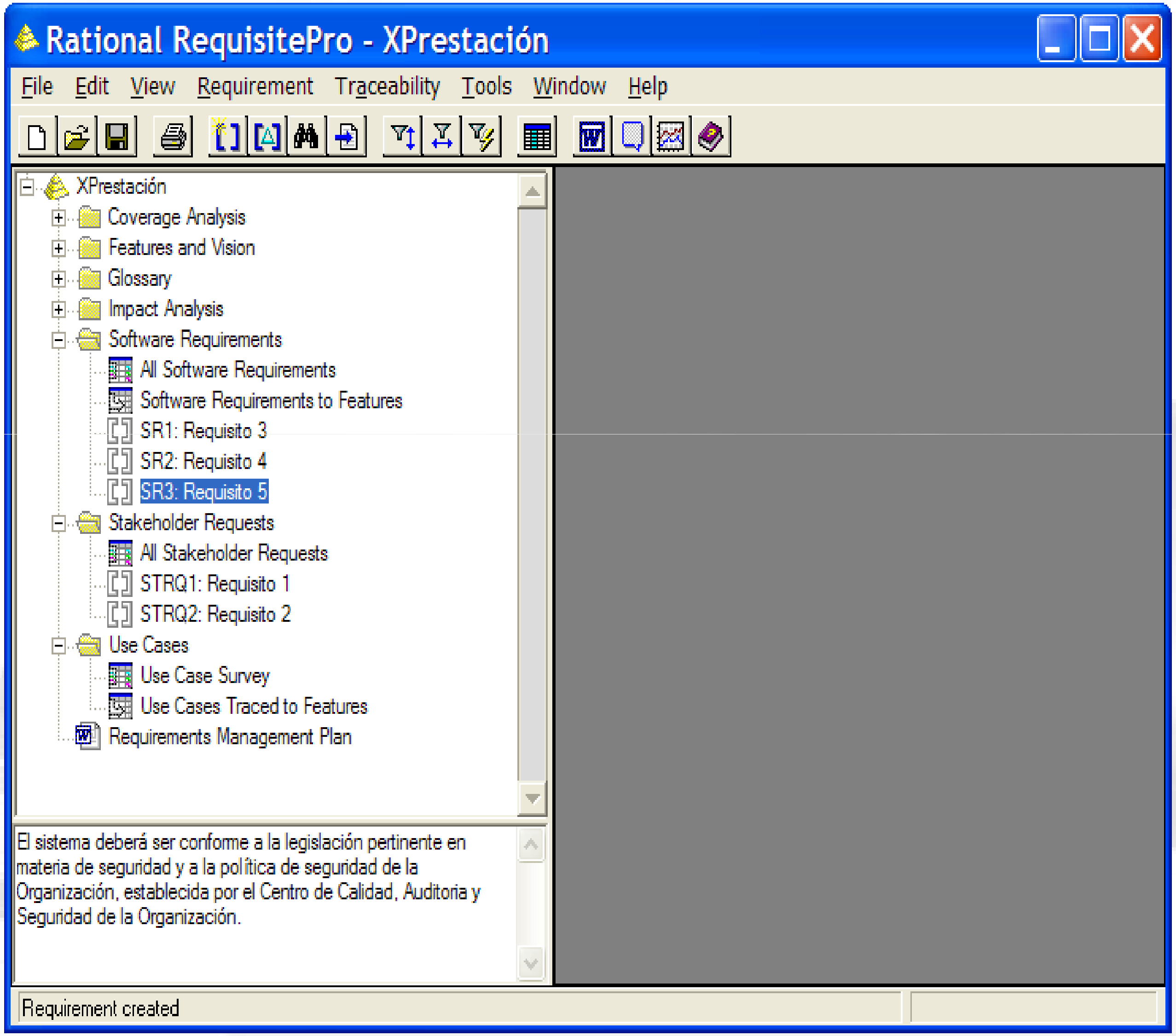
	RequisitePro	IRqA	DOORS	Caliber-RM
Extensibilidad de la funcionalidad	**Si, API basado en COM**	**Si, API basado en COM y JAVA**	**Si, API lenguaje DXL**	**Si, API basado en COM y JAVA**
Trazabilidad	**Si, entre los tipos de requisitos.**	**Si, entre tipos de requisitos, conceptos, UML, código, test.**	**Si, entre cualquier elemento del repositorio**	**Si, entre los tipos de requisitos y otros elementos.**
Integración con otras herramientas del ciclo de vida	**Si, con IBM Rational tools (Rational Rose, Rational TestManager, and Rational ClearQuest, MSProject, etc)**	**Si, con Office, IRqA-Rational Rose, Mercury TestDirector, CVS.**	**Si, mediante el lenguaje DXL.**	**Si, con Office, Project, Modelling, Testing e IDE tools.(Ej. Mercury TestDirector)**
Soporte reutilización	**No**	**No**	**No**	**No**
Repositorio del proyecto	**MS-Access, MS-SQL Server, Oracle**	**MS-SQL Server, Oracle, Informix, MySQL**	**Propietario**	**MS-Access y MS-SQL Server**
Validación de la especificación	**Si, con matriz de trazabilidad**	**Si, con matriz de trazabilidad**	**Si, con matriz de trazabilidad**	**Si, con matriz de trazabilidad**
Estándares de especificación	**Si, la salida puede adaptarse a las plantillas que se definan**	**Si, la salida puede adaptarse a diferentes formatos/plantillas**	**Si, la salida puede adaptarse a diferentes formatos**	**Si, la salida puede adaptarse a diferentes formatos**
Experiencia previa. Facilidad uso e Interfaz de usuario	**Si. Requisitos, vistas y documentos en una sola vista. Acceso web colaborativo**	**No. Organizada en vistas.**	**No. Difícil de seguir. Módulos y objetos**	**No. Práctica y amigable, orientada al entorno web**
Importación de requisitos	**Si, Word y CSV**	**Si, Word, CSV, Excel, XML**	**Si, Word y ficheros delimitados**	**Si, Word y ficheros delimitados**
Control de versiones y líneas base	**Si pero no comparables**	**Si y comparables**	**Si y comparables**	**Si y comparables**
Control acceso por roles y usuarios	**Si**	**Si**	**Si**	**Si**
Requisitos parametrizados	**No**	**No**	**No**	**No**

- Se decidió extender RequisitePro por su:
  - Extensibilidad
  - Integración automatizada con el resto de actividades del ciclo de vida
  - Experiencia previa
  - Facilidad de uso y Multiusuario
  - Trazabilidad
  - Otros: permite uso de plantillas, bbdd comerciales, etc…

❖ SREP Tool Repository Implementation



SREPTool - prototype



Rational RequisitePro - XPrestación
File Edit View Requirement Traceability Tools Window Help

- XPrestación
  - Coverage Analysis
  - Features and Vision
  - Glossary
  - Impact Analysis
  - Software Requirements
    - All Software Requirements
    - Software Requirements to Features
    - SR1: Requisito 3
    - SR2: Requisito 4
    - SR3: Requisito 5
  - Stakeholder Requests
    - All Stakeholder Requests
    - STRQ1: Requisito 1
    - STRQ2: Requisito 2
  - Use Cases
    - Use Case Survey
    - Use Cases Traced to Features
  - Requirements Management Plan

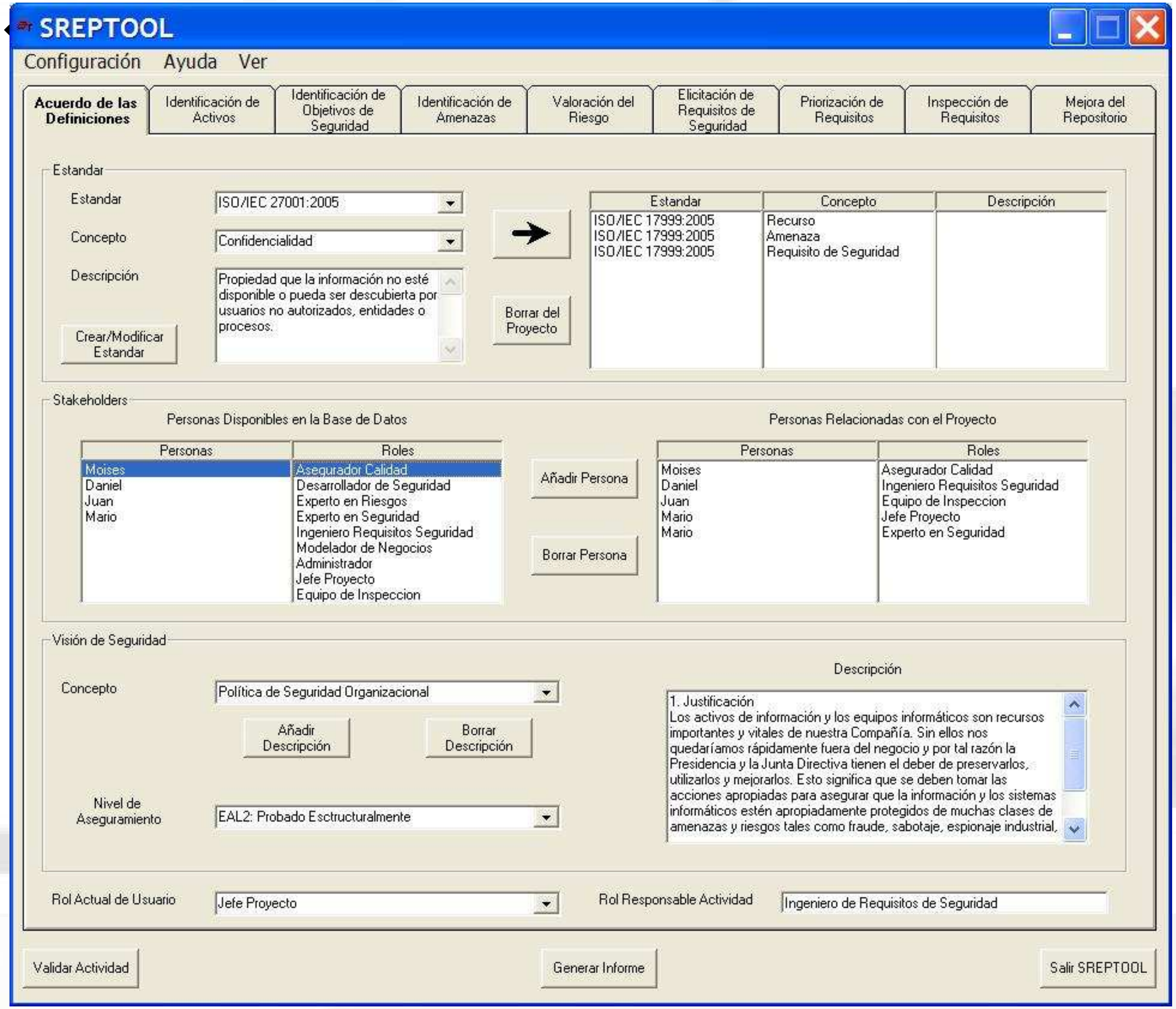
El sistema deberá ser conforme a la legislación pertinente en materia de seguridad y a la política de seguridad de la Organización, establecida por el Centro de Calidad, Auditoria y Seguridad de la Organización.

Requirement created

1 2 3 4

SREPTool - prototype

6



Estandar

Estandar: ISO/IEC 27001:2005

Concepto: Confidencialidad

Descripción: Propiedad que la información no esté disponible o pueda ser descubierta por usuarios no autorizados, entidades o procesos.

Estandar	Concepto	Descripción
ISO/IEC 17999:2005	Recurso	
ISO/IEC 17999:2005	Amenaza	
ISO/IEC 17999:2005	Requisito de Seguridad	

Stakeholders

Personas Disponibles en la Base de Datos

Personas	Roles
Moises	Asegurador Calidad
Daniel	Desarrollador de Seguridad
Juan	Experto en Riesgos
Mario	Experto en Seguridad
	Ingeniero Requisitos Seguridad
	Modelador de Negocios
	Administrador
	Jefe Proyecto
	Equipo de Inspeccion

Personas Relacionadas con el Proyecto

Personas	Roles
Moises	Asegurador Calidad
Daniel	Ingeniero Requisitos Seguridad
Juan	Equipo de Inspeccion
Mario	Jefe Proyecto
Mario	Experto en Seguridad

Visión de Seguridad

Concepto: Política de Seguridad Organizacional

Nivel de Aseguramiento: EAL2: Probado Esctructuralmente

Descripción

1. Justificación
Los activos de información y los equipos informáticos son recursos importantes y vitales de nuestra Compañía. Sin ellos nos quedaríamos rápidamente fuera del negocio y por tal razón la Presidencia y la Junta Directiva tienen el deber de preservarlos, utilizarlos y mejorarlos. Esto significa que se deben tomar las acciones apropiadas para asegurar que la información y los sistemas informáticos estén apropiadamente protegidos de muchas clases de amenazas y riesgos tales como fraude, sabotaje, espionaje industrial,

Rol Actual de Usuario: Jefe Proyecto

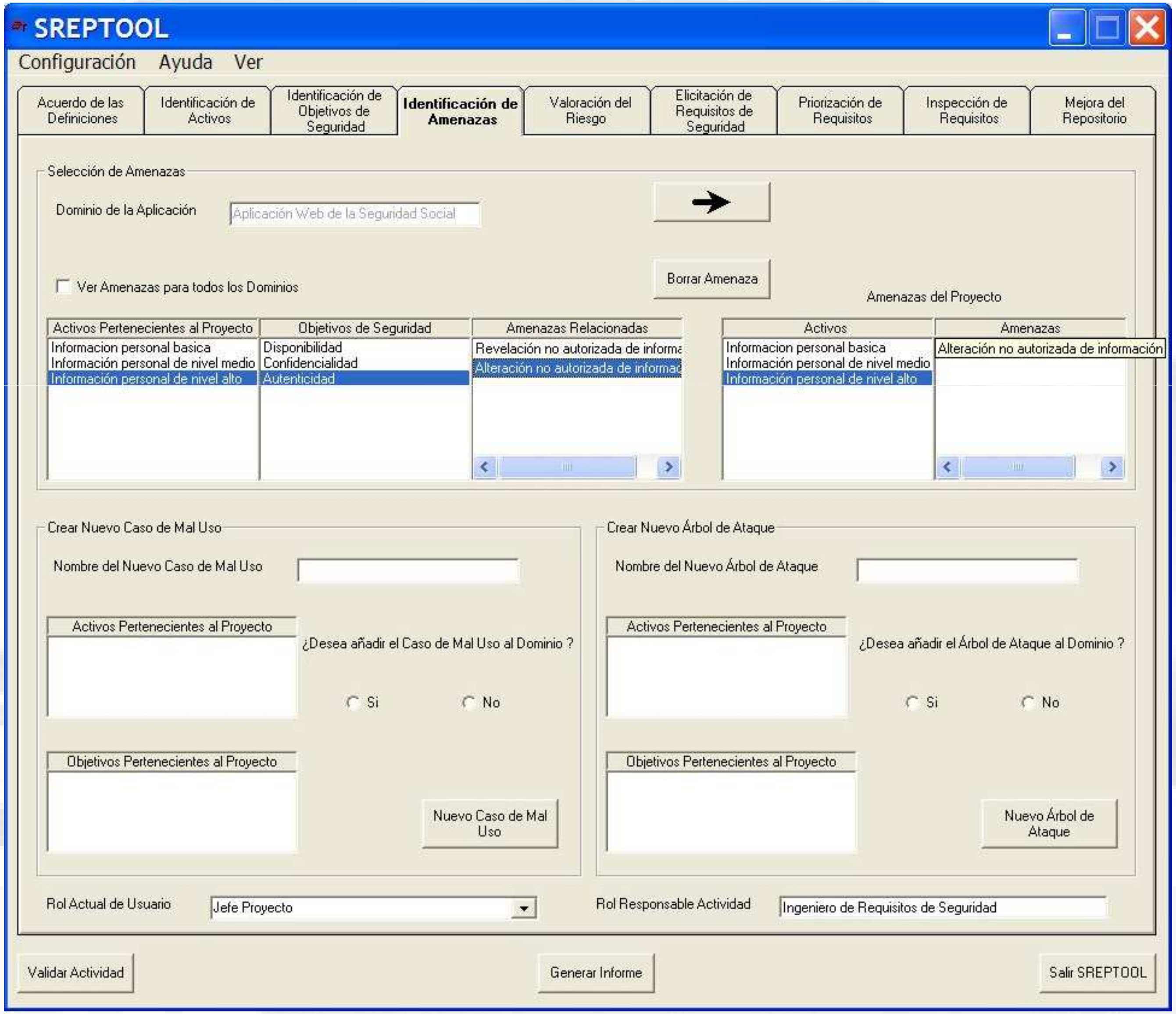
Rol Responsable Actividad: Ingeniero de Requisitos de Seguridad

1 2 3 4

SREPTool - prototype

6

❖


SREPTOOL
Configuración
Ayuda
Ver
Acuerdo de las Definiciones
Identificación de Activos
Identificación de Objetivos de Seguridad
Identificación de Amenazas
Valoración del Riesgo
Elicitación de Requisitos de Seguridad
Priorización de Requisitos
Inspección de Requisitos
Mejora del Repositorio
Selección de Amenazas
Borrar Amenaza
Crear Nuevo Caso de Mal Uso
Nombre del Nuevo Caso de Mal Uso
Activos Pertenecientes al Proyecto
¿Desea añadir el Caso de Mal Uso al Dominio ?
○ Si
○ No
Objetivos Pertenecientes al Proyecto
Nuevo Caso de Mal Uso
Crear Nuevo Árbol de Ataque
Nombre del Nuevo Árbol de Ataque
Activos Pertenecientes al Proyecto
¿Desea añadir el Árbol de Ataque al Dominio ?
○ Si
○ No
Objetivos Pertenecientes al Proyecto
Nuevo Árbol de Ataque
Validar Actividad
Generar Informe
Salir SREPTOOL

Dominio de la Aplicación: Aplicación Web de la Seguridad Social

□ Ver Amenazas para todos los Dominios

Activos Pertenecientes al Proyecto	Objetivos de Seguridad	Amenazas Relacionadas
Informacion personal basica	Disponibilidad	Revelación no autorizada de informa
Información personal de nivel medio	Confidencialidad	Alteración no autorizada de informac
Información personal de nivel alto	Autenticidad	

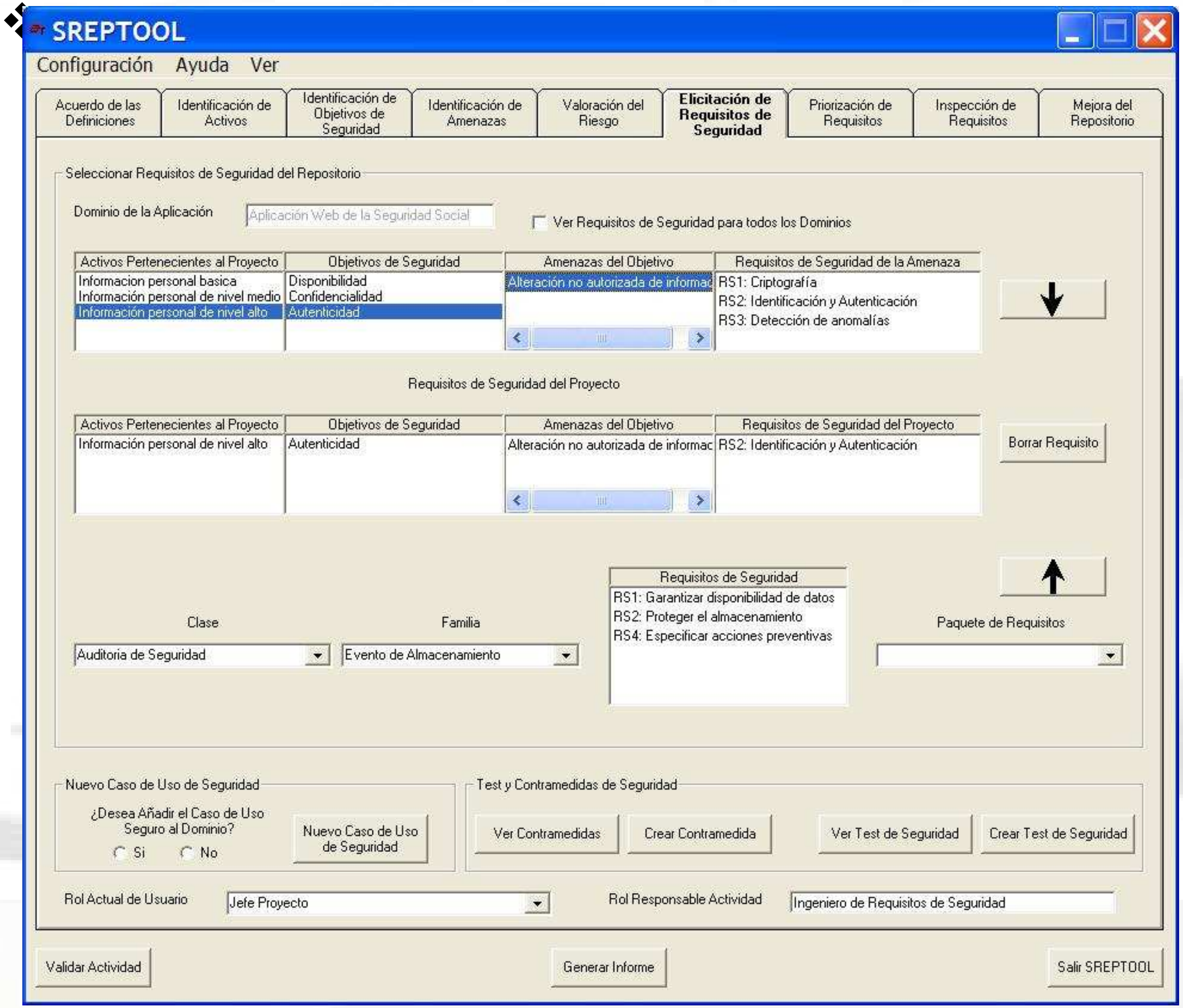
Amenazas del Proyecto

Activos	Amenazas
Informacion personal basica	Alteración no autorizada de información
Información personal de nivel medio	
Información personal de nivel alto	

Rol Actual de Usuario: Jefe Proyecto

Rol Responsable Actividad: Ingeniero de Requisitos de Seguridad

SREPTool - prototype



Seleccionar Requisitos de Seguridad del Repositorio

Dominio de la Aplicación: Aplicación Web de la Seguridad Social

□ Ver Requisitos de Seguridad para todos los Dominios

Activos Pertenecientes al Proyecto	Objetivos de Seguridad	Amenazas del Objetivo	Requisitos de Seguridad de la Amenaza
Informacion personal basica	Disponibilidad	Alteración no autorizada de informac	RS1: Criptografía
Información personal de nivel medio	Confidencialidad		RS2: Identificación y Autenticación
Información personal de nivel alto	Autenticidad		RS3: Detección de anomalías

Requisitos de Seguridad del Proyecto

Activos Pertenecientes al Proyecto	Objetivos de Seguridad	Amenazas del Objetivo	Requisitos de Seguridad del Proyecto
Información personal de nivel alto	Autenticidad	Alteración no autorizada de informac	RS2: Identificación y Autenticación

Clase: Auditoria de Seguridad

Familia: Evento de Almacenamiento

Requisitos de Seguridad
RS1: Garantizar disponibilidad de datos
RS2: Proteger el almacenamiento
RS4: Especificar acciones preventivas

Paquete de Requisitos:

Nuevo Caso de Uso de Seguridad

¿Desea Añadir el Caso de Uso Seguro al Dominio?
○ Si ○ No

Test y Contramedidas de Seguridad

Rol Actual de Usuario: Jefe Proyecto

Rol Responsable Actividad: Ingeniero de Requisitos de Seguridad

Conclusions and Further Work

- The increasingly crucial nature of IS with corresponding levels of new legal and governmental requirements → development of more and more sophisticated approaches to ensuring the security of information → it is fundamental to deal with security at the early stages of software development
- We demonstrate how the security requirements for a security critical IS can be obtained in a guided and systematic way by applying SREP
- Our proposal deals with the security requirements at the early stages of software development in a systematic and intuitive way
  - reusability (Security Resources Repository).
  - integration of the CC
  - standards ISO/IEC 15408 (CC), ISO/IEC 17799:2005, and ISO/IEC 13335 (GMITS).
  - techniques (miss-use cases, UMLSec,…)
  - micro-process of 9 activities, iterative and incremental

Conclusions and Further Work

- ❖ Further Work…
  - – We are developing a CARE (Computer-Aided Requirements Engineering) tool which supports the process (current prototype: SREPTool)
  - – A refinement of the theoretical approach by proving it in real case studies.
- ❖ More details with regards SREP (our suggested methodology) can be found in :
  - – Daniel Mellado, Eduardo Fernández-Medina, Mario Piattini: A common criteria based security requirements engineering process for the development of secure information systems. Computer Standards & Interfaces 29(2): 244-253 (2007)

Thank you for your attention!!

Any Question??

Speaker:

Rafael Gómez Lago
GSyA Research Group, University of Castilla La-Mancha (Spain)

Authors:

Dr. Daniel Mellado
(damefe@esdebian.org)
GSyA Research Group, University of Castilla La-Mancha (Spain)

Dr. Eduardo Fernández-Medina
(Eduardo.FdezMedina@uclm.es)
GSyA Research Group, University of Castilla La-Mancha (Spain)

Dr. Mario Piattini (Mario.Piattini@uclm.es)
Alarcos Research Group, University of Castilla La-Mancha (Spain)