Trusted Computing Engineering for Resource Constrained Embedded Systems Applications

Deliverable D8.2

Dissemination Material

Table of Contents

1 Document History

Version	Status	Date
V0.1	draft	15/01/2012
V1.0	final	30/01/2012

Approval		
	Name	**Date**
Prepared	Antonio Kung	10/02/2012
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European Commission	20/02/2012	

2 Introduction

The dissemination of information is a key requirement of the TERESA project. TERESA research, development, and conclusions are valuable only if they are not shared with other projects, universities and companies. TERESA has disseminated its information in the following ways:

- **Presentations**: presentations made at conferences by TERESA partners
- **Publications**: papers published in journals by TERESA partners
- **Website**: the TERESA website
- **Factsheet**: a TERESA factsheet for the European Commission's Portfolio of Embedded Systems Projects
- **Flyer**: a TERESA flyer to be distributed at meetings, workshops and conferences
- **Project Presentation**: a general presentation of the TERESA project to be shown at conferences and workshops.

The following sections detail these activities and documents.

3 Presentations

The TERESA partners have made numerous of presentations at conferences since the start of project. Links to the slides of the presentations and the conference web sites can be found on the TERESA website at http://www.teresa-project.org/presentations. The presentation details are as follows:

	2012 Presentations
Conference	**Security Engineering Forum**
Date, Place	2 February 2012, Malaga, Spain
Presentation	TERESA Facts and Vision
Author	Antonio Kung (Trialog)
Conference	**5th International Conference on Computers, Privacy, and Data Protection European Data Protection: Coming of Age: Workshop on Privacy Impact Assessment: Past, Present, and Future**
Date, Place	25-27 January 2012, Brussels, Belgium
Presentation	From PIAs to Engineering Practices
Author	Antonio Kung (Trialog)
	2011 Presentations
Conference	**ACM/IEEE 14th International Conference on Model Driven Engineering Languages**
Date, Place	Date, Place:16-21 October 2011, Wellington, New Zealand
Presentation	Enforcing S&D Pattern Design in RCES with Modeling and Formal Approaches
Author	Brahim Hamid (IRIT), Sigrid Gürgens (Fraunhofer SIT), Christophe Jouvray (Trialog), Nicolas Desnos (IRIT)
Conference	**The Sixth International Conference on Software Engineering Advances**
Date, Place	23-29 October 2011, Barcelona, Spain
Presentation	Presentation: A Metamodel for Representing Safety LifeCycle Development Process
Author	Authors:Yulin Zhang, Brahim Hamid, Damien Gouteux (IRIT)
Conference	**International Workshop on Security and Dependability for Resource Constrained Embedded Systems**
Date, Place	22 September 2011, Naples, Italy
Presentation	Analysis of the SYM2 Smart Meter Remote Software Download Using Formal Methods Reasoning
Author	Andreas Fuchs (Fraunhofer SIT), Donatus Weber (University of Siegen)
Conference	**3rd International Workshop on Model-driven Approaches in Software Product Line Engineering and 3rd Workshop on Scalable Modeling Techniques for Software Product Lines**
Date, Place	21 August 2011, Munich,Germany
Presentation	Towards Variability Support for Security and Dependability Patterns
Author	Brahim Hamid, Nicolas Desnos (IRIT, University of Toulouse), Salvador Trujillo, David Gonzalez (Ikerlan- IK4)
Conference	**Modelisation Vertrauen, Datenschutz, Sicherheit und Innovation: Journées Neptune 2011**
Date, Place	17-18 May 2011, Paris, France

Presentation	Modélisation à base de patrons de sécurité et de sûreté pour les systèmes embarqués contraints en ressources – l'approche TERESA
Author	Brahim Hamid, Nicolas Desnos (IRIT)
Presentation	Illustration et utilisation de l'approche TERESA dans l'industrie
Author	Christophe Jouvray (Trialog)
Conference	**IT-Sicherheit - Vertrauen, Datenschutz, Sicherheit und Innovation**
Date, Place	10 February 2011, Berlin, Germany
Presentation	Sicherheit für die Verwaltung eingebetteter Systeme
Author	Jan Pelzl (escrypt)
	2010 Presentations
Conference	**IEEE International Conference on Embedded and Ubiquitous Computing**
Date, Place	11-13 December 2010, Hong Kong, China
Presentation	An Environment for Design Software and Hardware Aspects of Clock Synchronization and Communication in DRTES
Author	Authors:Brahim Hamid, Adel Ziani (IRIT)
Conference	**S&D4RCES: International Workshop on Security and Dependability for Resource Constrained Embedded Systems - S&D RCES by Design**
Date, Place	14 September 2010, Vienna, Austria
Presentation	Enforcing Trust in Embedded Systems Using Models
Author	Christophe Jouvray, Michel Sall, Antonio Kung (Trialog)
Presentation	Formalization of Smart Metering Requirements
Author	Andreas Fuchs, Sigrid Güergens (Fraunhofer SIT), Donatus Weber, Christian Bodenstedt, Christoph Ruland (University of Siegen)
Presentation	Security Engineering for Embedded Systems: The SecFuture Vision
Author	Sigrid Güergens, Carsten Rudolph (Franunhofer SIT), Antonio Maña (University of Malaga), Simin Nadjm-Tehrani (Linköping University)
Presentation	Model-Based Security and Dependability Patterns in RCES: The TERESA Approach
Author	Brahim Hamid (IRIT), Cyril Grepet (Trialog)
Presentation	Towards the Integration of Advanced Engineering Paradigms into RCES: Raising the Issues for the Model-Driven Product-Line Case
Author	David Gonzalez, Antonio Pérez, Salvador Trujillo (Ikerlan IK4)
Conference	**8th Nordic Workshop on Model Driven Software Engineering**
Date, Place	23-26 August 2010, Copenhagen, Denmark
Presentation	Model-Based Engineering for Dynamic Reconfiguration in DRTES
Author	Brahim Hamid, Fatma Krichen (IRIT)
Conference	**3rd International Conference on Telecommunications, Electronics and Informatics**
Date, Place	20-23 May 2010, Chisnau Moldova
Presentation	Integration of Security and Dependability into Resource Constrained Embedded Systems
Author	Christian Bodenstedt, Christoph Ruland, Donatus Weber (University of Siegen), Antonio Kung (Trialog)

4 Publications

The TERESA partners have published numerous articles since the start of project. Links to the text of the publications can be found on the TERESA website at http://www.teresa-project.org/publications. The publications details are as follows:

	2011 Publications
Title	**A Metamodel for Representing Safety LifeCycle Development Process**
Author	Yulin Zhang, Brahim Hamid, Damien Gouteux (IRIT)
Publisher	CSEA 2011, The Sixth International Conference on Software Engineering Advances (ICSEA 2011)
Date	October 2011
Text	Think Mind Analysis of the SYM2 Smart Meter Remote Software Download Using Formal Methods Reasoning
Title	**Analysis of the SYM2 Smart Meter Remote Software Download Using Formal Methods Reasoning**
Author	Andreas Fuchs (Fraunhofer SIT), Donatus Weber (University of Siegen)
Publisher	Proceedings of S&D4RCES 2011 Workshop, in the Proceedings of the International Workshop on Security and Dependability for Resource Constrained Embedded Systems (SAFECOMP 2011)
Date	October 2011
Text	ACM DL Digital Library
Title	**Enforcing S&D Pattern Design in RCES with Modeling and Formal Approaches**
Author	Brahim Hamid (IRIT), Sigrid Gürgens (Fraunhofer SIT), Christophe Jouvray (Trialog), Nicolas Desnos (IRIT)
Publisher	Proceedings of the ACM/IEEE 14th International Conference on Model Driven Engineering Languages 2011 (MODELS 2011)
Date	October 2011
Text	Text:(to appear)
Title	**Towards a Unified Meta-model for Resources-Constrained Embedded Systems**
Author	Adel Ziani, Brahim Hamid (IRIT), Salvador Trujillo (Ikerlan)
Publisher	IEEE Computer Society
Date	September 2011
Text	ACM DL Digital Library
Title	**Towards a Model-Based Approach for Reconfigurable Distributed Real Time Embedded Systems**
Author	Fatma Krichen, Brahim Hamid (IRIT, University of Toulouse), Bechir Zalila, Mohamed Jmaiel (Redcad, University of Sousse)
Publisher	Proceeding of the European Conference on Software Architecture (ECSA 2011)
Date	September 2011
Text	Springer
Title	**Vers une Technique de Développement de Patrons de Sécurité et de Fiabilité pour les Systèmes Embarqués Contraints en Ressources.**
Author	Brahim Hamid, Nicolas Desnos (IRIT, University of Toulouse), Christophe Jouvray (Trialog)

Publisher	Génie Logiciel, GL & IS
Date	September 2011
Text	(to appear)
Title	**Towards Variability Support for Security and Dependability Patterns**
Author	Brahim Hamid, Nicolas Desnos (IRIT, University of Toulouse), Salvador Trujillo, David Gonzalez (Ikerlan- IK4)
Publisher	Proceedings of the 3rd International Workshop on Model-driven Approaches in Software Product Line Engineering and Software Product Line Conference (SPLC/MAPLE/SCALE 2011)
Date	August 2011
Text	ACM DL
	2010 Publications
Title	**An Environment for Design Software and Hardware Aspects of Clock Synchronization and Communication in DRTES**
Author	Brahim Hamid, Adel Ziani (IRIT):
Publisher	Proceedings of IEEE/IFIP 8th International Conference on Embedded and Ubiquitous Computing (EUC 2010)
Date	December 2010
Text	IEEE Xplore
Title	**Enforcing Trust in Embedded Systems Using Models**
Author	Christophe Jouvray, Michel Sall, Antonio Kung (Trialog)
Publisher	Proceedings of S&D4RCES '10 Workshop, in the Proceedings of the International Workshop on Security and Dependability for Resource Constrained Embedded Systems (SAFECOMP 2010)
Date	September 2010
Text	ACM DL Digital Library
Title	**Formalization of Smart Metering Requirements**
Author	Andreas Fuchs, Sigrid Gürgens (Fraunhofer SIT), Donatus Weber, Christian Bodenstedt,Christoph Ruland (University of Siegen)
Publisher	Proceedings of S&D4RCES '10 Workshop, in the Proceedings of the International Workshop on Security and Dependability for Resource Constrained Embedded Systems (SAFECOMP 2010)
Date	September 2010
Text	ACM DL Digital Library
Title	**Model-Based Security and Dependability Patterns in RCES – the TERESA Approach**
Author	Brahim Hamid, Nicolas Desnos (IRIT, University of Toulouse), Cyril Grepet, Christophe Jouvray (Trialog)
Publisher	Proceedings of S&D4RCES '10 Workshop, in the Proceedings of the International Workshop on Security and Dependability for Resource Constrained Embedded Systems (SAFECOMP 2010)
Date	September 2010
Text	ACM DL Digital Library
Title	**Towards the Integration of Advanced Engineering Paradigms into RCES: Raising the Issues for the Safety-Critical Model-Driven Product-Line Case**

Author	Salvador Trujillo, Antonio Perez, David Gonzalez (Ikerlan- IK4), Brahim Hamid (IRIT, University of Toulouse)
Publisher	Proceedings of S&D4RCES '10 Workshop, in the Proceedings of the International Workshop on Security and Dependability for Resource Constrained Embedded Systems (SAFECOMP 2010)
Date	September 2010
Text	ACM DL Digital Library
Title	**Security Engineering for Embedded Systems: The SecFutur Vision**
Author	Sigrid Gürgens, Carsten Rudolph (Fraunhofer SIT), Antonio Maña (University of Malaga), Simin Nadjm-Tehrani(Linköping University)
Publisher	Proceedings of S&D4RCES '10 Workshop, in the Proceedings of the International Workshop on Security and Dependability for Resource Constrained Embedded Systems (SAFECOMP 2010)
Date	September 2010
Text	ACM DL Digital Library
Title	**Model-Based Engineering for Dynamic Reconfiguration in DRTES**
Author	Brahim Hamid, Fatma Krichen (IRIT)
Publisher	8th Nordic Workshop on Model Driven Software Engineering (NW-MODE 2010)
Date	August 2010
Text	available on TERESA website
Title	**Integration of Security and Dependability into Resource Constrained Embedded Systems**
Author	Christian Bodenstedt, Christoph Ruland, Donatus Weber (University of Siegen), Antonio Kung (Trialog)
Publisher	3rd International Conference on Telecommunications, Electronics and Informatics (ICTEI 2010)
Date	May 2010
Text	available on TERESA website

5 TERESA Website

The TERESA website is found at www.teresa-project.org. There are currently web pages for the following topics:

- **Home**: General introduction to the project.

- **Objectives**: Detailed description of the tasks and goals of the project.

- **Approach**: The approach used in the research and development stages.

- **News**: Notable activities of members of the project.

- **Presentations**: Papers presented in academic and industrial symposiums and conferences.

- **Publications**: Papers published in professional and academic journals.

- **Deliverables**: A list of TERESA deliverables, with the public ones available in a pdf file.

- **Factsheet**: The basic administrative details of the project.

- **Consortium members**: A list of the consortium members with links to their websites.

- **Advisory Board:**
    - A list of the Advisory Board members with a brief biography of each
    - The slides and summary of the first Advisory Board meeting
    - The slides and summary of the second Advisory Board meeting

- **Contacts**: Contact information for each partner of the project.

- **Links**: Links to related projects and related information.

6 TERESA Factsheet

TERESA prepared a factsheet at the request of the European Commission, DG Information Society, Unit G3, Information & Communication Technologies - Embedded Systems & Control. The factsheet is a part of a publication entitled Portfolio of Embedded Systems Projects, ICT-2009.3.4.

The EC provided the template for the factsheet. The target audience is the general public. The following two pages present the content of the TERESA factsheet.

TERESA Fact Sheet page 1

TRUSTED COMPUTING ENGINEERING FOR RESOURCE CONSTRAINED EMBEDDED SYSTEMS APPLICATIONS

TERESA

Key Innovation

Resource Constrained Embedded Systems (RCES) are systems for Information and Communication Technology (ICT) that are integrated into a wide variety of applications, such as automotive and railway electronics, appliances, sensors, building control systems, and smart meters. They have stringent cost constraints, for example being limited to 1€ microcontrollers. They are often integrated into critical applications (e.g. a car breaking system) which may require strict certification.

RCES must increasingly integrate additional features for Security and Dependability (S&D), such as a secure communication mechanism. The development of such features requires specialised expertise and skills, but the cost of designing them from scratch could surpass the cost of developing the rest of the system. For instance, the development of a security component for an electricity meter requires 1) expertise in security that is seldom available in the metering industry and 2) expertise in the engineering process and validation practice of metering which is not always available in the S&D community.

TERESA's key innovation is an approach that *supports the re-use of independently developed S&D features without having to re-engineer them. This is achieved through the adaptation of model-based techniques.* Thus the overhead for integrating an S&D feature would be a fraction of the expected overall development cost and time.

Technical approach

TERESA's technical approach is based on separating the development of S&D subsystems from the development of RCES. S&D engineers develop *S&D patterns* using a *model-based process* and store the results in a repository. Specific tools are used to enter and update patterns in the repository. Then RCES engineers can then reuse and integrate an S&D pattern into their application by using their own dedicated tool to adapt it to their domain, their technology platform, and their engineering process. More specifically:

- S&D patterns are described and modelled with dedicated tools at different levels (e.g. at general or domain specific levels) and stored in a repository to facilitate their reuse.
- The engineering process of a specific domain is captured as a profile of the repository to enable a specific view of the stored patterns. Specific application dependent tools are available to facilitate the smooth integration of a given pattern into the RCES of a particular sector.

Contract number

248410

Project coordinator

Rolf Riemenschneider

Contact person

Antonio Kung

Trialog

25, rue du Général Foy

75009

Paris, France

Tel: +33 144 70 61 00

Fax: +33 144 70 05 91

antonio.kung@trialog.com

Project website

www.teresa-project.org

Community contribution to the project

3.79 million Euro

Project start date

1 November 2009

Duration

39 months

TERESA Fact Sheet page 2

TERESA will provide two tools, as seen in the figure below. The first allows S&D experts to design an S&D subsystem and store it in a repository of patterns to be reused. The second tool allows developers of RCES in a specific application sector to reuse the S&D subsystem during their application design process.
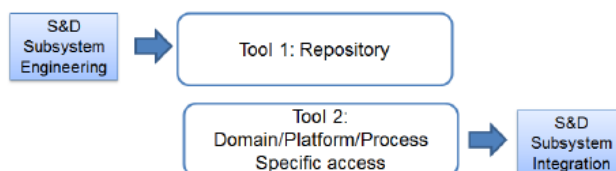
TERESA Tools for Design and Reuse of S&D Subsystems.

Demonstration and Use

Two demonstration applications will be developed:

- A railway use case: the distance between trains must be controlled. This is a highly critical function so the calculation of distance is based on redundant voting-based capability. TERESA will demonstrate *that the reuse of such capability during the development of the overall railway application system can be achieved in a smooth and economic way.*

- A smart grid use case: smart electricity grids are based on smart meters which need to be securely accessed and possibly modified. TERESA will demonstrate *that the reuse of such capability during the development of the overall smart metering system can be achieved in a smooth and economic way.*

Scientific, Economic and Societal Impact

Industrial partners of the consortium will 1) increase competeness by applying the cost and time effective reuse approaches developed in TERESA, 2) enhance and market the repository access tools developed in TERESA, and 3) provide consulting services to develop and market reusable components.

Academic partners of the consortium will 1) create an engineering curriculum based on the results of TERESA and 2) provide a broader education to students in the RCES domain.

The benefit to the general population is the assurance that critical ICT infrastructures including most, if not all, RCES will be based on sound and cost effective engineering approaches. This will also contribute to more trust in ICT.

| Project partners	Country
TRIALOG – project co-ordinator	France
escrypt	Germany
Fraunhofer SIT	Germany
Ikerlan-IK4	Spain
Université de Toulouse IRIT	France
Universität Siegen	Germany

First achievements

Definition of use case scenarios, identification of requirements, initial technical design of TERESA tools.

Future Internet Research and Experimentation

7 TERESA Flyer

TERESA has created a flyer to distribute at meetings, workshops and conferences.   The following four pages present the contents of the TERESA flyer.

TERESA Flyer page 1
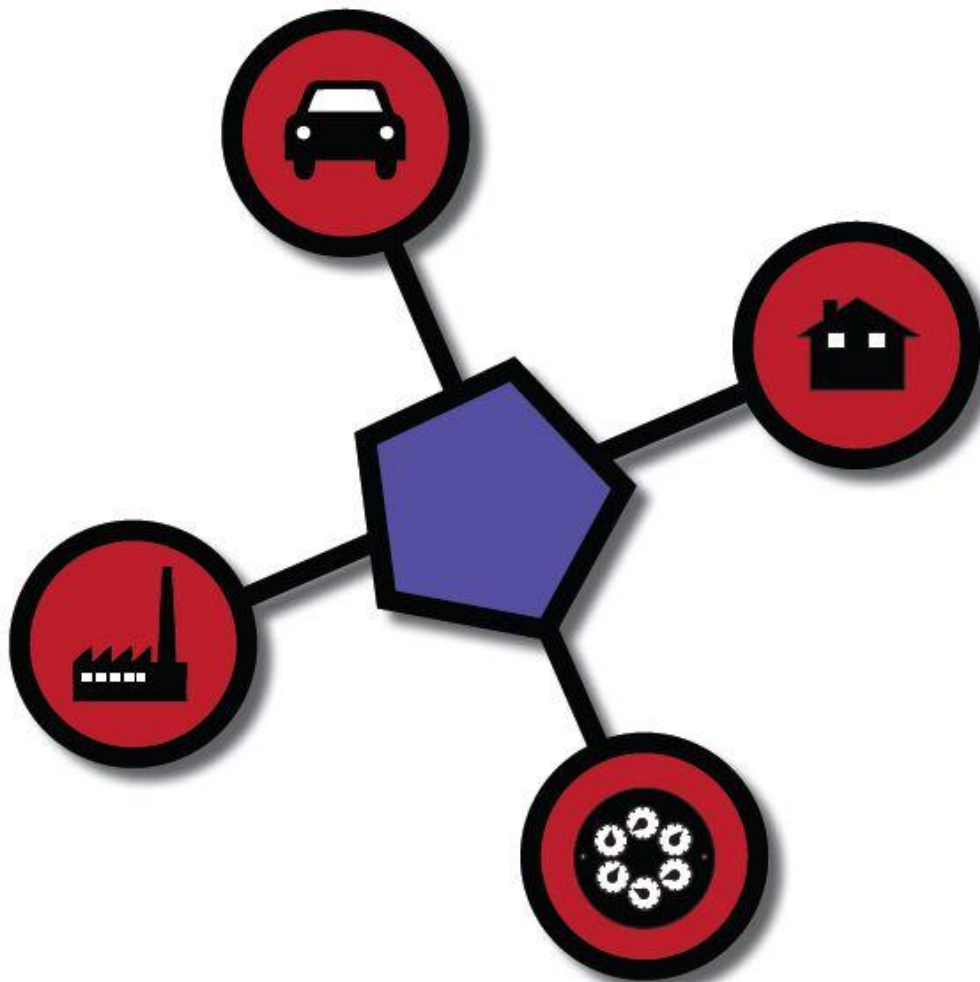
TERESA Flyer page 2

Teresa

Focuses on Trust, Security and Dependability in Resource Constrained Embedded Systems

Main Objectives

The goal of TERESA is to define, demonstrate and validate an engineering discipline for trust that is adapted to resource constrained embedded systems. Trust is defined as the degree with which security and dependability requirements are met. Resource Constrained Embedded systems (RCES) are characterised as follows:

- They are used by different application sectors.

- Computing resources are mostly statically determined and allocated through a process consisting of a configuration phase and a building phase.

- They are generally high integrity systems with strong assurance requirements. They therefore use advanced engineering disciplines.

TERESA has the following objectives:

- Provide guidelines for the specification of sector specific RCES trusted computing engineering. Software process engineers in a given sector can then use the guidelines to define a trusted computing engineering process that is integrated with the software engineering process used in their RCES sector.

- Define a trusted computing engineering approach that is adaptable to different sectors. The result will be applied to test applications in different sectors.

Pattern Structure

Key Words

Security, Dependability, Trust, Models, Patterns, Engineering, Resource Contrained Embedded Systems

Key Technologies

Patterns
Patterns are widely used today to specify architecture and design aspects. They refer to templates which describe solutions for commonly occurring problems. A key advantage is that security and dependability experts can provide patterns which might not be available in companies involved in the development of RCES.

Models
Model Driven Engineering (MDE) is a technique for software development in which all or a part of an application is generated from models. MDE engineering is widely used in embedded systems where assurance requirements are crucial. The TERESA vision is that S&D patterns that are derived from and associated with domain specific models will help application developers to integrate application building blocks with S&D building blocks. For this reason, TERESA advocates the use of a model-based repository, in which patterns are clearly related to domain models.
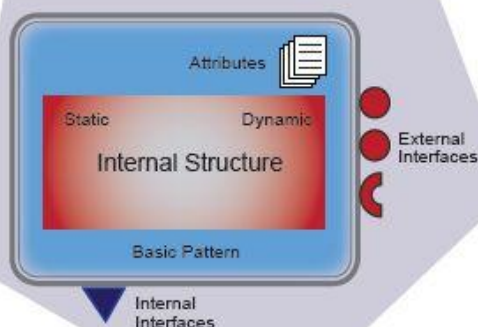
Repository
The definition of an engineering discipline for trust that is adapted to resource constrained embedded systems must take into account the requirements of all the sectors, since not all RCES have the same needs. TERESA uses a repository of S&D patterns described with a model-based approach.

Process Validation in Different Sectors
The engineering process for resource constrained embedded systems will be validated by adapting the TERESA approach to the systems of four application sectors:

- Automotive
- Home control
- Industry control
- Metering

TERESA Flyer page 3

Technical Approach

The TERESA approach is to use a model-based repository of Security and Dependability (S&D) patterns:

- Application sector trust models are defined as profiles (e.g. UML, SysML profiles) which are based on a common trust meta-model.

- S&D platform independent patterns are identified and defined for each application sector, while some patterns could be used by several application sectors.

- Formal properties of S&D are defined and validated for patterns belonging to application sectors requiring a certain level of assurance.

- Platform dependent implementation of the patterns is guided by precise requirements.

Module for secure V2X communication

Expected Impact

TERESA contributes to the security and reliability of Information and Communication Technology (ICT) through the increased productivity of embedded system development. The engineering process promotes the separation of engineering concerns. It provides application designers with the following benefits:

- The reuse of state-of-the-art S&D solutions.

- The advantage of MDE and pattern based approaches. The MDE approach allows the reuse of S&D artefacts at an earlier stage of design.

- The repository access tool allows application designers to have the advantage of MDE even though they do not use MDE for application design and are not experts in modelling.

TERESA's engineering process takes into account domain specific processes. This allows for the support of specific standards, as well as the assurance of the approach.

TERESA's open repository facilitates the emergence of new tools for repository access. This will in turn encourage the emergence and growth of new companies.

TERESA contributes to European leadership in embedded system design and competitiveness in the area of trusted computing engineering of resource constrained embedded systems.

In the future, new systems used for the Internet, for alternative paths to ICT components and systems, and for ICT sustainable development will be resource constrained embedded systems. By focusing on the trusted computing engineering aspects of such systems, TERESA will contribute to the advent of such breakthroughs.

Teresa Processes
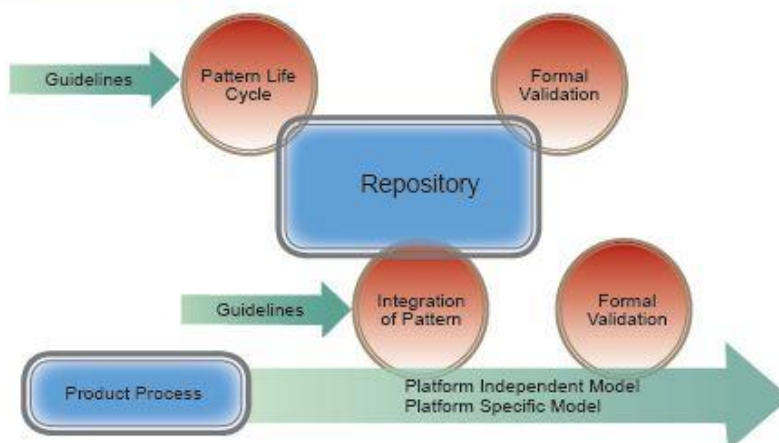
TERESA Flyer page 4

**Trusted Computing Engineering
for Resource Constrained Embedded Systems Applications**

TERESA Consortium
TRIALOG: Paris, France
escrypt: Bochum, Germany
Fraunhofer SIT: Darmstadt, Germany
Ikerlan-IK4: Mondragon, Spain
IRIT: Toulouse, France
Universität Siegen: Siegen, Germany

Project Website
www.teresa-project.org

Project Coordinator
Antonio Kung
TRIALOG
25 rue du Général Foy
75008 Paris, France
Tel: +33 1 44 70 61 00
Fax: +33 1 44 70 05 91
antonio.kung@trialog.com

Project Details
Start date: 1 November 2009
Duration: 36 months
Reference: IST-248410

The TERESA project is part of the Information Society Technologies initiative and the Seventh Framework Programme of the European Commission.

8 TERESA General Presentation

TERESA has created a general project presentation for meetings and conferences. It provides an overview of the essential facts, vision, and approach of the project. The following pages contain a copy of this presentation.

Facts About TERESA

Antonio Kung
Trialog
TERESA Coordinator

2 February 2012   Security Engineering Forum   1

TERESA

- **T**rusted computing **E**ngineering for **R**esource constrained **E**mbedded **S**ystems **A**pplications
  - 39 Month Project (1/11/2009 – 31/01/2013)
  - Budget: € 3 554 951
  - Funding: € 2 899 996
  - www.teresa-project.org

1 February 2012   Security Engineering Forum   2

Partners

- Université de Toulouse II – Le Mirail
  - Modelling, dependability
- Fraunhofer SIT
  - Formal validation of security and dependability
- Trialog
  - Tools related to MDE, trust models elicitation, home control, automotive applications
- Ikerlan-IK4
  - Dependability in industry control applications
- escrypt :
  - Security for embedded systems
- U.Siegen
  - Security for metrology

1 February 2012   Security Engineering Forum   3

TERESA Vision

Antonio Kung

Trialog

TERESA Coordinator

2 February 2012   Security Engineering Forum   4

RCES: Resource Constrained Embedded Systems

- Many application sectors
  - Automotive electronics, railway electronics, appliances, sensors, building control systems, and smart meters.
- Cost constraints, e.g. 1€ microcontrollers.
- Different levels of integrity with associated assurance requirements.
  - Use advanced engineering disciplines
- Computing resources often statically determined
  - Process involving a configuration phase and a build phase

1 February 2012   Security Engineering Forum   5

Problem

- RCES must increasingly integrate additional features for Security and Dependability (S&D)
- S&D Engineering very specialised
  - RCES often developed by small companies/teams
  - Reusability of know-how and building blocks wanting
- Cost of designing them from scratch could surpass the cost of developing the rest of the system.

1 February 2012   Security Engineering Forum   6
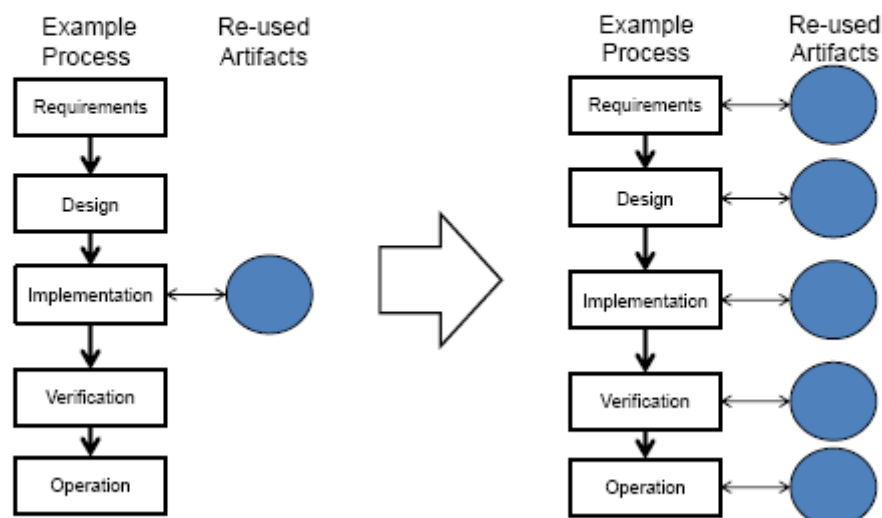
Vision

- Approach to re-use independently developed S&D features without having to re-engineer them.
- Adaptation of model-based techniques.
- Overhead for integrating an S&D feature will be a fraction of the expected overall development cost and time

1 February 2012 — Security Engineering Forum — 7

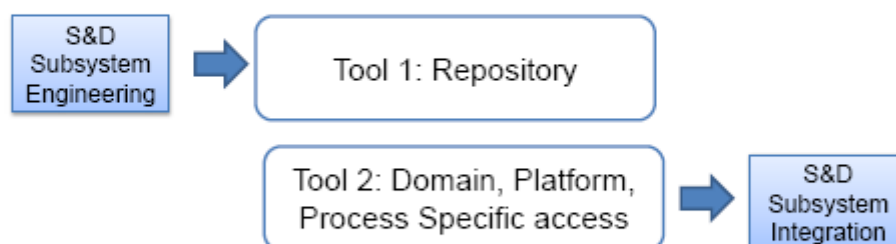Vision: From Development to Engineering

1 February 2012 — Security Engineering Forum — 8

Demonstrators

- A railway use case
  - Control of distance between trains
  - Calculation based on secure voting pattern
- A smart metering use case
  - Secure access, secure update
- TERESA will demonstrate *that the reuse of S&D patterns can be achieved in a smooth and economic way.*

1 February 2012   Security Engineering Forum   11

Thank you

www.teresa-project.org

2 February 2012   Security Engineering Forum   13