



Assessing, Measuring  
and Benchmarking Resilience

# Project Motivation



- Measuring resilience is the key stone to improving trustworthiness in computer systems and components.

*"If you cannot measure something,  
you cannot really understand it"*  
(Lord Kelvin)



- Coordination and agreement on a research agenda are essential to address the big challenges on resilience assessment posed by current and forthcoming computer systems and computer-based infrastructures.

# The Consortium



- Slim Consortium
  - University of Coimbra (FCTUC)
  - Budapest University of Technology and Economics (BME)
  - Chalmers University of Technology (Chalmers)
  - City University London (City)
  - University of Newcastle upon Tyne (UNEW)
  - University of Florence (UNI-FI)
  - ResilTech S. R. L. (ResilTech)
- A large and representative **Advisory Board**
  - 15 members ++
  - Provide input from the computer industry and organizations
  - Provide dissemination links for AMBER results.

# Main objectives



- Build consensus on **common understanding**, methodologies and practices for resilience assessment;
- **Integrate and coordinate** European research and practice on resilience assessment;
- **Establish** a resilience assessment and benchmarking **research forum** through AMBER web portal;
- Build and maintain a **data repository** to analyze and share resilience measurement data.
- **Foster** the effective transfer of resilience assessment **best practices** to European industry, namely contribute to the adoption of resilience benchmarks by industry;
- **Promote** the proposal of **standards** for resilience assessment and benchmarking;
- Propose a **research agenda** on assessing and benchmarking resiliency of systems and infrastructures.

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# Project Overview and Workpackages



**WP0 Coordination Action Management**

**WP1 - Coordination and information exchange platform**

- **Set up and maintain an open web portal**
  - Coordinate the interactions among partners
  - Exchange and disseminate AMBER activities
- **Develop and maintain a data repository**
  - Analyse and share **raw data** from dependability assessment experiment and (sanitized) field data.
  - Accessible to the community (with adequate privacy protection).

# Project Overview and Workpackages



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## WP2 - Characterization of resilience assessment methods and tools

- **Survey of state of the art**
  - Research and current practice at industry
  - Previous EC projects
  - Systematic evaluation of methods and tools
  - Continuously updated during the project
- **Liaisons with relevant organizations to harmonise current practices with AMBER proposals**
  - European Technology Platforms
  - Standardisation Bodies and European Agencies
  - ICT metrology associations and certified bodies

# Project Overview and Workpackages



- Analysis and **identification of gaps** and research opportunities
- Definition of a **research roadmap**

resilience assessment  
d tools

**WP0 Coordination  
Management**

**WP1 - Coordinati  
information exchange**

**WP3 Analysis and roadmap**

**WP4 - Dissemination and Training**

# Project Overview and Workpackages



- Organization of **panels** on resilience assessment in major conferences
- Organization of **workshops**
- Organization of **tutorials** on resilience assessment in major conferences
- **Promotion of standard** initiatives and benchmark acceptance.

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**WP4 - Dissemination and Training**



**AMBER data repository:  
field and resilience  
experiments data**

# AMBER Repository vision and objectives



- Vision
  - Become the worldwide repository for dependability related data (field data & experiment data)
- Objectives
  - Make raw experimental data and (sanitized) field data available
  - Provide state-of-the-art data analysis
  - Allow data comparison and cross-exploitation
  - Facilitate worldwide data sharing and dissemination
  - Help Identifying trends on assessing, measuring, and benchmarking resilience

# Proposed approach

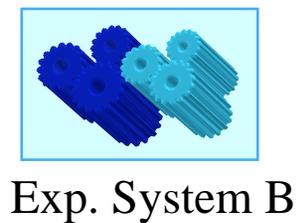
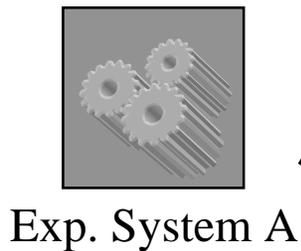


- Clear separation between the experimental setups and the system/tools used to analyze the results
- Use a business intelligence approach:
  - **Data warehouse** to store experimental results
  - On-Line Analytical Processing (**OLAP**) applications to analyze the results (statistical and ad-hoc analysis)
  - **Data mining** algorithms to identify (unknown) potentially interesting phenomena in the data
  - **Information retrieval** for raw data heavily base on text and XML
- Adopt the same life cycle of BI data
- Use technology already available for DW & DM

# Key points of the proposed approach



## Data collection

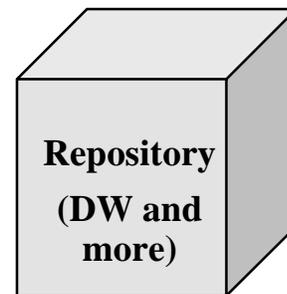


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## Result Analysis and sharing

Multidimensional/  
raw data server



Internet

Result analysis

Ad hoc  
OLAP  
queries

Statistical  
Reporting

Data  
Mining

IR based  
analysis

**AMBER  
Repository**

# Steps needed to put data into the repository (1)



1. User registration and/or authentication
2. Definition of the adequate data schema to store the data. Create the tables in the DW
3. Definition of data access policies for the data
  - Proprietary data
    - Everyone can read and analyze
    - Only the author can add new data
  - Collaborative approach
    - Everyone can read
    - Everyone can add new data

# Steps needed to put data into the repository (2)



4. Use general-purpose loading application to **define the loading plans** for each table in the star schema
5. **Run the loading plans** to load the tables in the repository with the data collected from the experiments
  - Every time a new experiment is done loading plans are run again to add the new data to the DW
6. **Analyze the data using OLAP and data mining:** calculate measures, find unexpected results, analyze trends, etc.



- Proving the concept and technology using raw data from some available experiments and field data (universities studies only):
  - Benchmarking experiments in OLTP systems (VLDB 2003, DSN 2003, DSN 2004)
  - Experiments in a break by wire real time systems (EDCC 2007)
  - Comparative analysis of failure detectors (DSN 2005)
  - Field data on web application vulnerabilities (DSN 2008)
- **Defining a business model for the data repository**