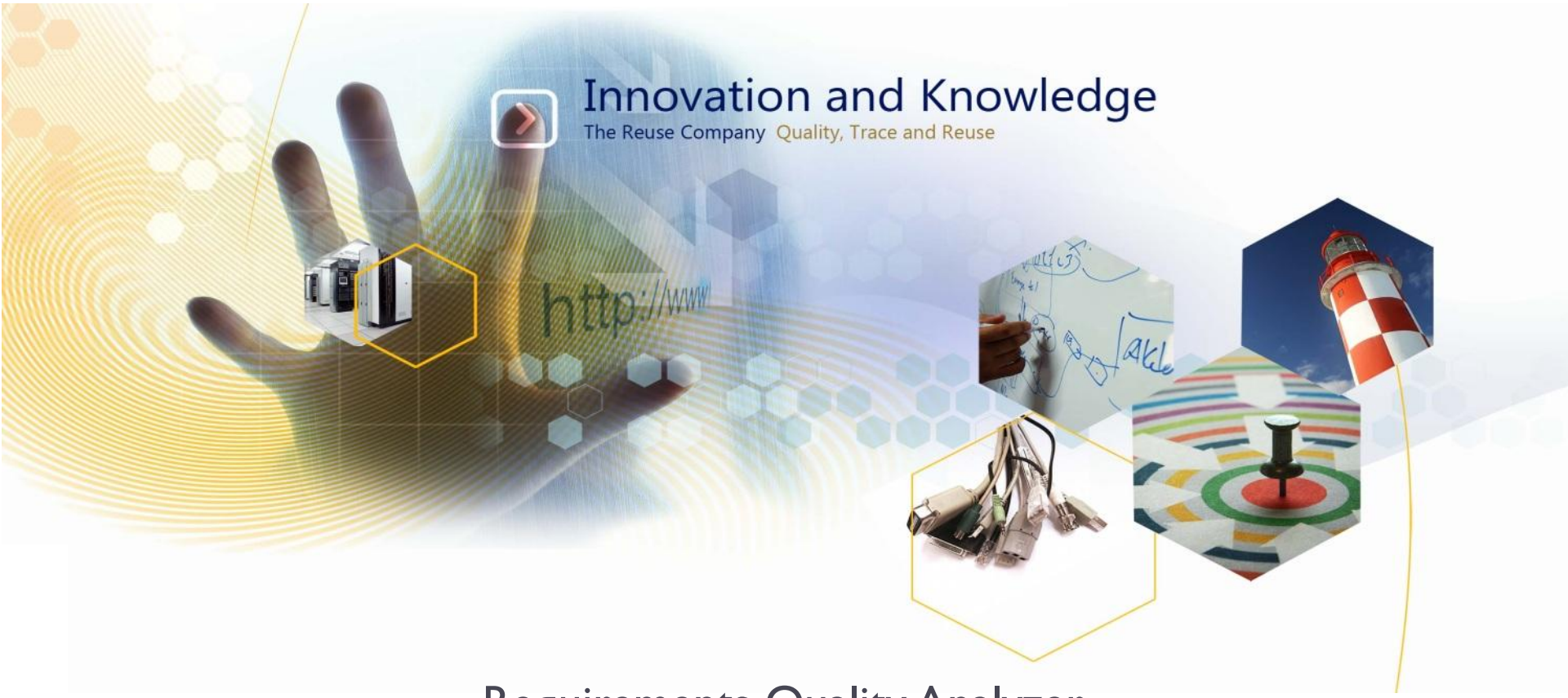
The Reuse COMPANY



Requirements Quality Analyzer

www.reusecompany.com

Contents

What is The Reuse COMPANY

In the Reuse Company's vision, knowledge reuse is fully integrated in every organization's productivity chain.

Our mission is to promote Systems/Software (S/S) and knowledge reuse within an organization, by offering processes, methods, tools and services that make it possible.

Our main efforts are oriented to Systems/Software Reuse, Traceability and Quality

We are a small European IT company, that have operated only in Europe until 2010.

2011's goal is the complete internationalization.

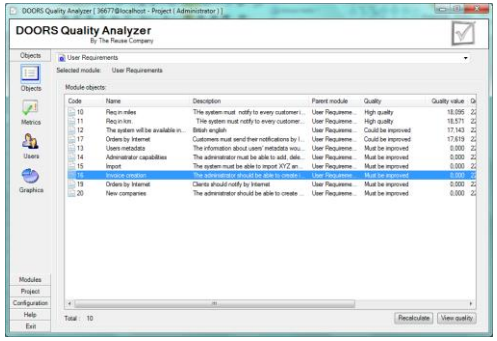
What is the Requirements Quality Analyzer - RQA

The Requirements Quality Analyzer is a software tool that aids quality assessment and improvement within requirements oriented software and systems projects.

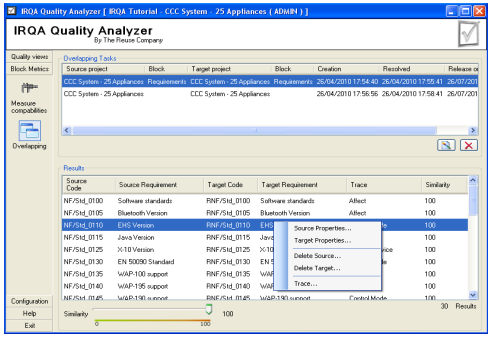
RQA allows to define, measure, improve and manage the quality of requirements specifications in systems and software projects.

The assessment is modeled by evaluating metrics.

- Measures single requirements quality



- Measures requirements sets quality



RQA Features

Metrics

- Metrics based model for measuring and improving quality
- Supports text based and NON text based measures
- Supports metrics for individual requirements and sets of requirements
- Customizable measures calculation engine

Functional Operation

- Multi roles operability (Engineer, Project Manager, QA Manager)
- Calculations can be performed on-line (on demand) or planned.
- Fully integrated with RMS

Semantics

- Formal semantic requirements meta-model
- Fully supports the customer's Domain representation (ontology)
- Domain Specific Language can be incorporated to the ontology

Individual requirements supported metrics

- Size
- Readability
- Conditional vs. imperative sentences
- Optional sentences
- Ambiguous sentences
- Subjective sentences
- Implicit sentences
- Abuse of connectors
- Negations
- Speculative sentences
- Design terms
- Flow terms
- Number of domain nouns and verbs
- Acronyms
- Hierarchical levels
- Volatility
- Number of dependences

Individual requirements supported metrics 1/3

- **Size:** expressed in paragraphs, chars, nouns or verbs. Long requirements will be difficult to understand
- **Readability:** number of letters between punctuation marks and some other formulas than indicate whether the requirement will be easy to read. Ease to read requirements generates less problems all over the project
- **Conditional sentences vs. imperative sentences:** avoid *would* and use *Shall, should* and *will* in the right way
- **Optional sentences:** maybe… Optional requirements must be stated by an attribute, never in the body of the requirement
- **Ambiguous sentences:** fast, user-friendly… What do the analyst, the coder and the customer understand by the same ambiguous sentence
- **Subjective sentences:** in my opinion, I think that… Don't show your ideas, but what the system should do

Individual requirements supported metrics 2/3

- **Implicit sentences:** it must be provided by them… Too many pronouns make your requirements difficult to understand
- **Abuse of connectors:** and, or. Many times connectors reveal different needs enclosed within the same requirement, loosing the atomic characteristic
- **Negations:** no, never… Two or more negations in the same sentence make it difficult to understand
- **Speculative sentences:** usually, almost always… Make the requirement imprecise
- **Design terms:** loop, hash… Remember, avoid How, concentrate in What
- **Flow terms:** while, if, else… Remember avoid How, concentrate in What

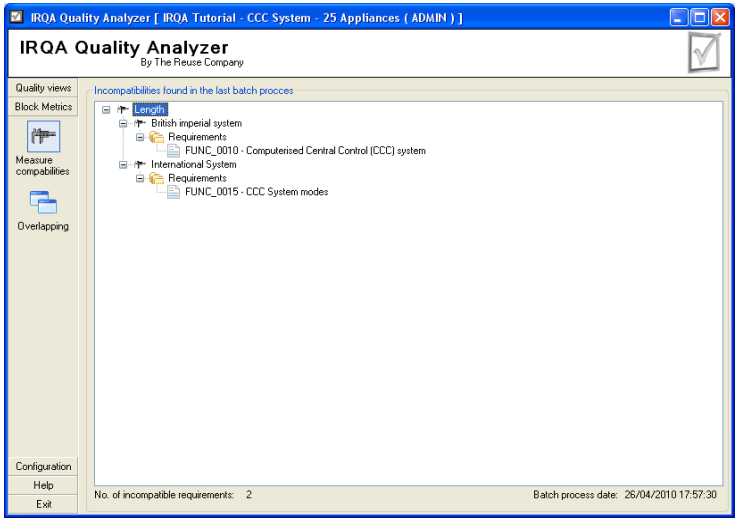
Individual requirements supported metrics 3/3

- **Number of domain nouns and verbs:** domain terms and verbs should be involved into the requirement specification, nevertheless, too many different terms in the same requirement many times means multiple needs
- **Acronyms:** avoid those that don't belong to the domain representation
- **Hierarchical levels:** don't complicate your specification with too many indentation levels
- **Volatility:** if a requirement suffers many changes, you must be very careful with it
- **Number of dependences:** the same if your requirement is the source of too many dependences

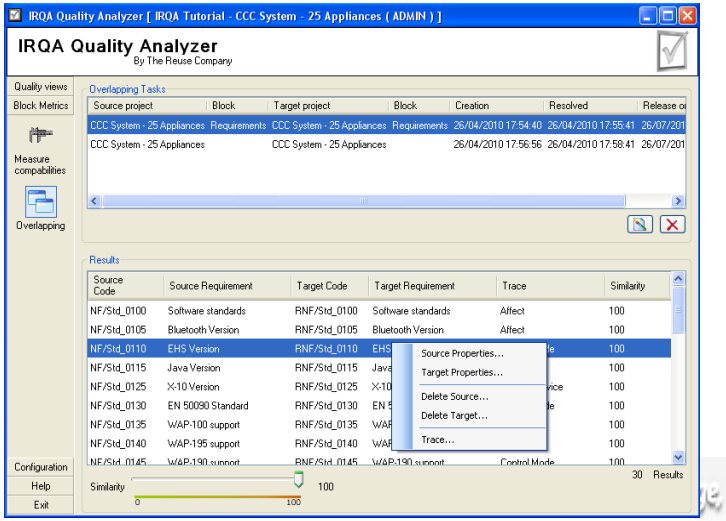
Requirements sets supported metrics

- Unlike individual requirements metrics, **global metrics** involve a whole set of requirements (a requirement project or module)
- These metrics are defined to take a global understanding of some common mistakes

Use of inconsistent units



Coupling matrix



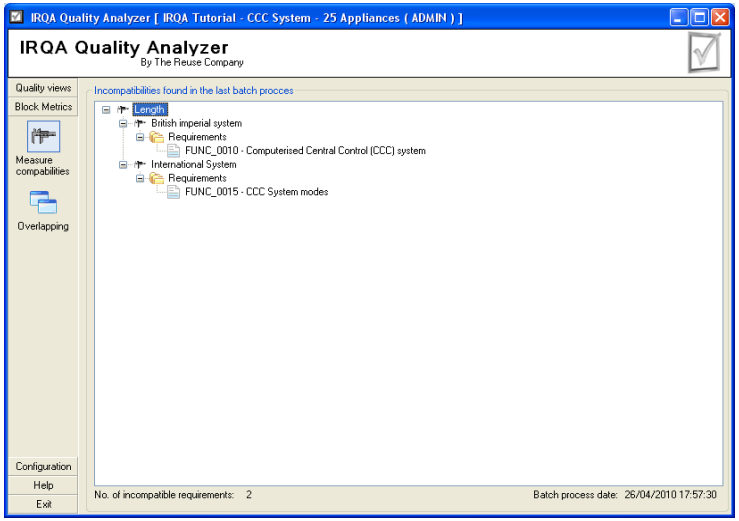
Requirements sets supported metrics

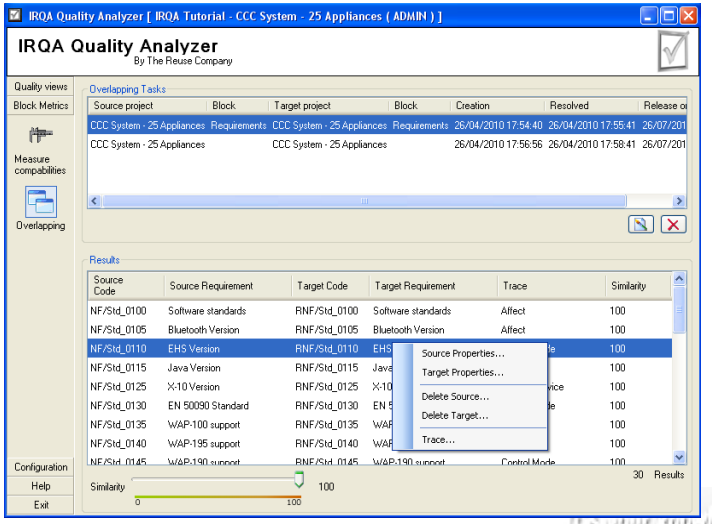
- **Inconsistent units**

  The use of incoherent units in different requirements must be checked and notified. E.g. to use meters and inches, pounds and Kg., Celsius and Fahrenheit.

- **Overlapping Matrix**

  Measure the possibility to include similar or overlapped requirements in the same of different projects.

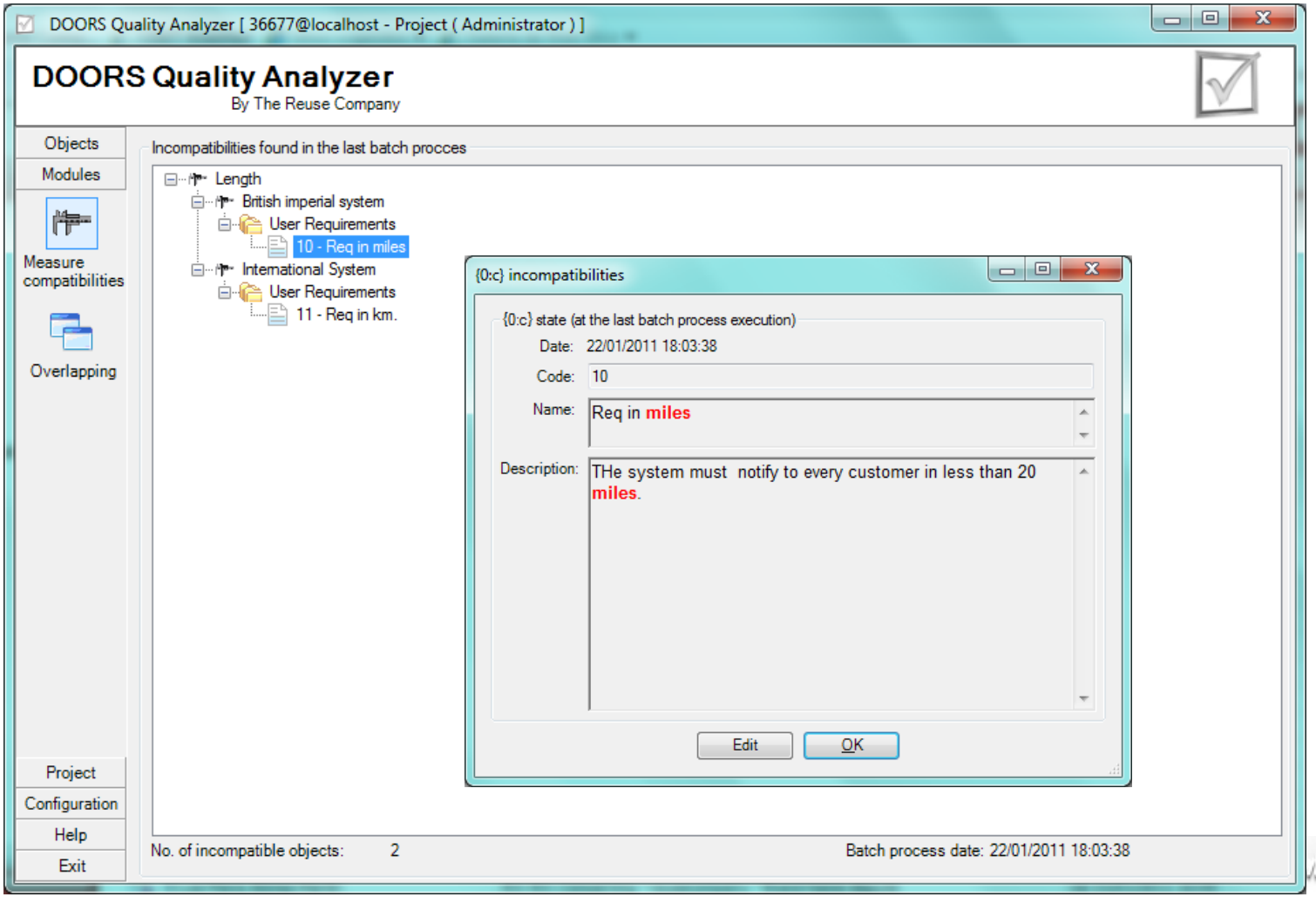




Requirements sets supported metrics : inconsistent units

- **Root problem:** inconsistent requirements could be difficult to find, therefore, the cost of finding them in later stages of the SDLC or even in a production environment is really high
- **Goal:** try to detect, in the same Requirements project, the use of non-consistent units (e.g. two different requirements measuring something in yards and meters)
- **Management:** RQA, out-of-the-box, already includes many of the most common measurement units. The user is able to extend this list at any moment
- **Solution:**
  - The pairs of requirements that include these inconsistent units are automatically identified by the tool
  - The user can now change the textual content of the requirements

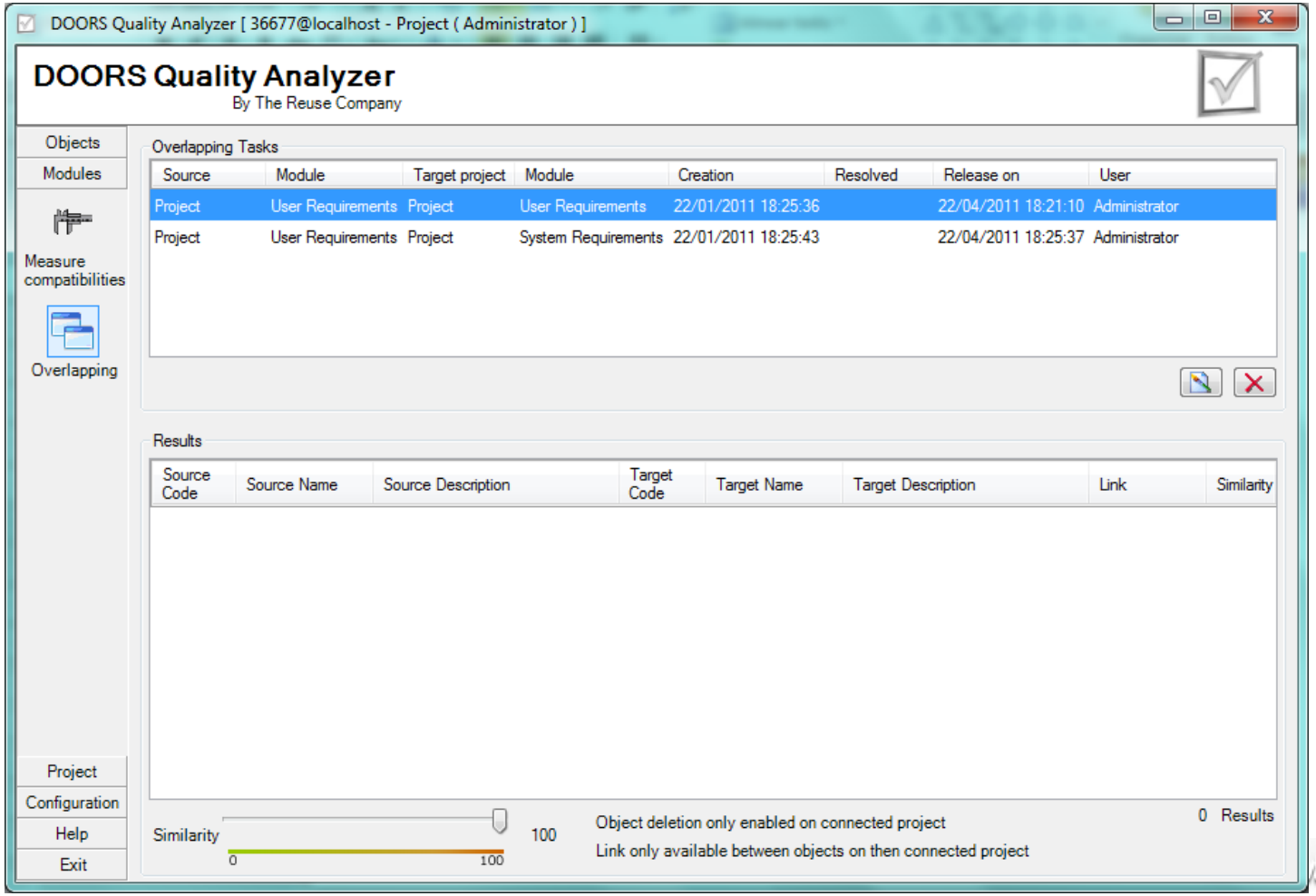
Requirements sets supported metrics : inconsistent units



Requirements sets supported metrics : coupling matrix

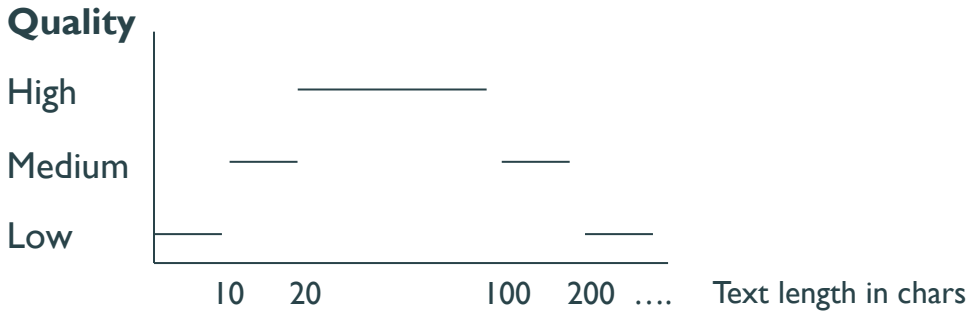
- **Root problem:** coupled specification could be the source of inconsistent specifications, therefore, the cause of many rework and poor quality projects
- **Goal:** automatically detect coupling (overlapping) inside a single module or even among different modules or projects
- **Approach:**
  - Generate a semantic graph out of every single requirement: using linguistic techniques together with ontologies
  - This graphs don't relay on the words in the requirements, but in the real meaning (semantics) of a whole sentence
  - The tool compares those graphs to find out the semantic similarity among requirements
- **Solution:** once detected, the user can easily remove a requirement or add a trace relationship between both requirements

Requirements sets supported metrics : coupling matrix

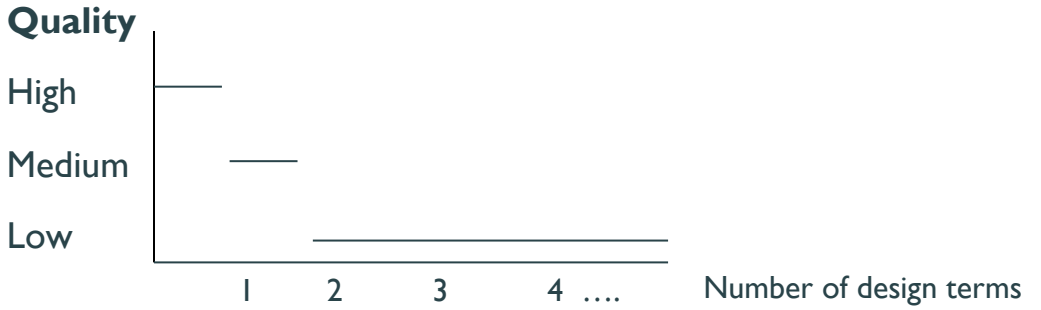


Quality Functions

- Convex quality function:



- Decreasing quality function:



- Increasing quality function:

Functional Operation

- QA Team (defines the reference Quality policies)
  - Defines a set of quality functions for every metric
  - Defines the quality ranges (values) for every metric
  - Defines the default assignments of active metrics to engineer profiles
- Project Managers
  - Define the particular assignments of active metrics for particular projects
  - Define their own quality results to measure (graphs)
- Business Analyst
  - For every requirement and every metric, a numerical value is generated
  - Using a set of quality functions, every metric is qualified as: high, medium and low quality
  - An aggregated quality value is generated for every requirement

User's Roles

RQA supports a multi-role functional operation within a software/systems intensive organization

Quality Assurance	 **Improve or verify quality within the organization**	Quality policy Quality evolution: thresholds Process improvement: training, support
Project Manager	 **Improve project performances**	Quality Cost Delays goals Best practices fulfilling Identify gaps: quality evolution vs teams Process improvement: training, support
System Engineer	 **Improve work efficiency**	Requirements Quality Identify critical issues: bad formulations, ambiguous terms inconsistencies Process improvement: self training

Use Cases

RQA supports a multi-role functional operation within a software/systems intensive organization

Quality Assurance

I need to state my quality policy regarding requirements specifications
I want to settle thresholds to measure the quality evolution
I need to know how quality is evolving in my organization
Which quality aspects should we enforce by organizational training

Project Manager

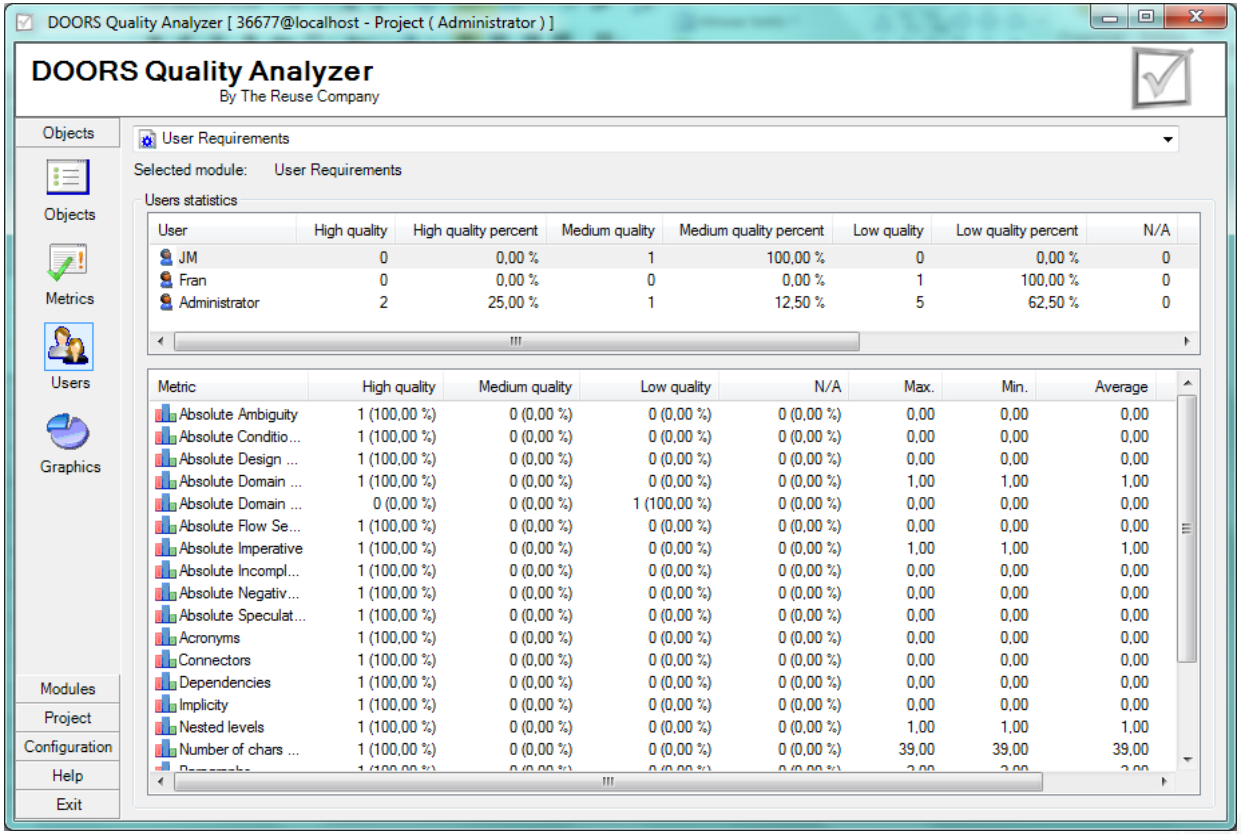
The quality of my projects meets my expectations?
Are we fulfilling our best practices?
How is project quality evolving over the time?
Who is performing better/worst in my team?
Where should I focus team training?
Are project/team requirements consistent among them?

System Engineer

The quality of my requirements meets my expectations?
What requirements should be reviewed?
What features of the requirements should I review?
What terms should be avoided?
What are the most frequent mistakes in my requirements?
Where to start with in a peer-review?

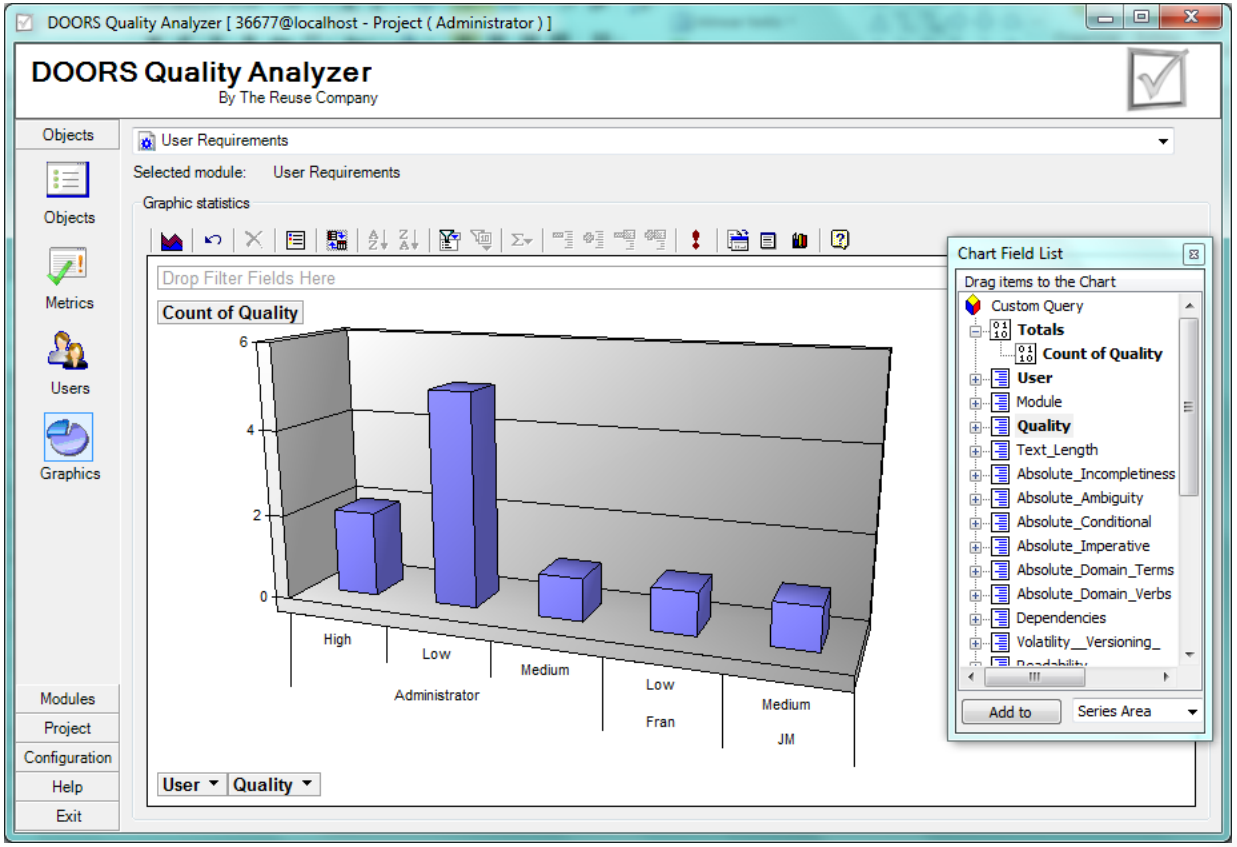
Quality assurance role

Quality Assurance

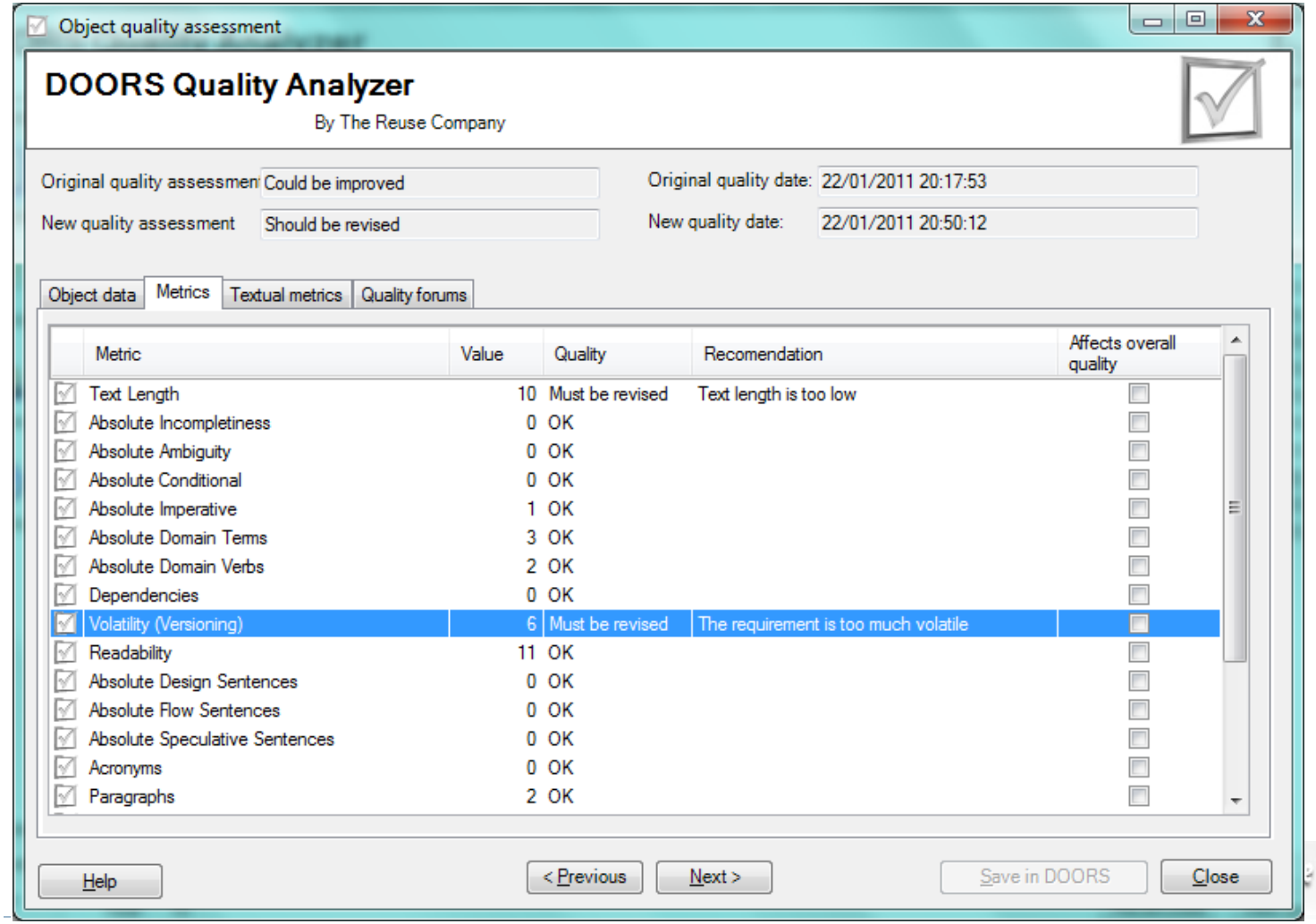


Project manager role

Project Manager



Business analyst role

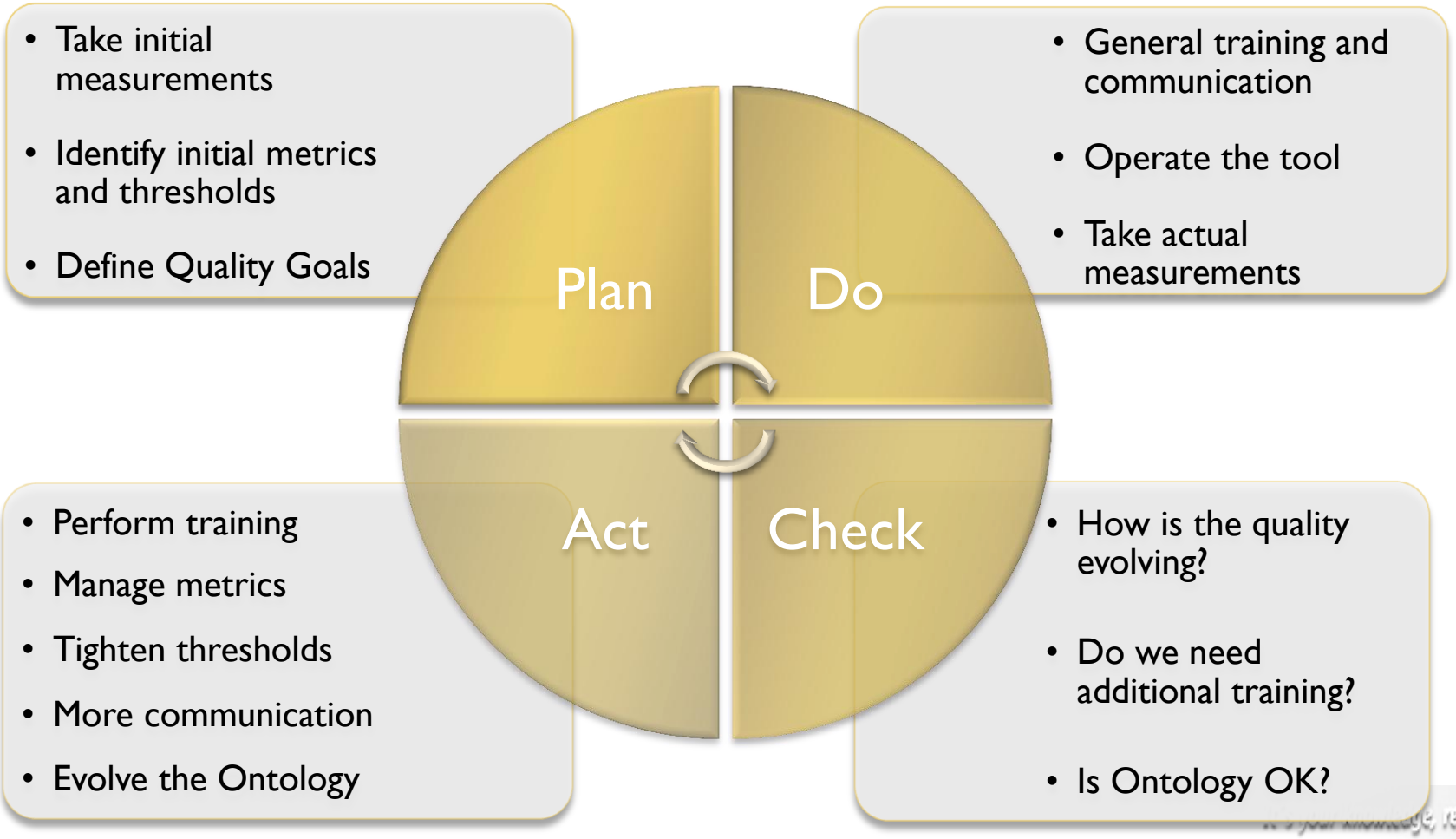


Business Analyst

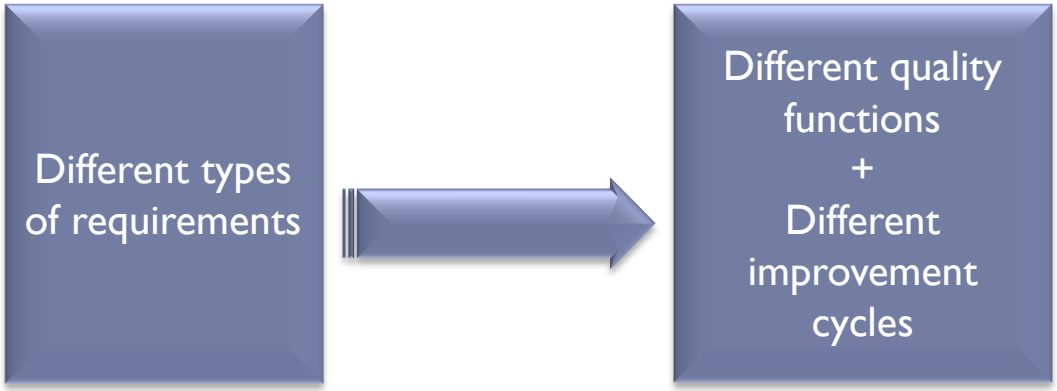
Quality improvement process: PDCA

- Valid and invalid thresholds can be established in a flexible way:
  - According to the company's culture and way of working
  - Different threshold for every set of requirements:
    - Project / block / module
- Some metrics can be disabled if needed
- As we flow around the improvement cycle, the maturity level is improving
- How to implement an improvement cycle:

Quality improvement process: PDCA

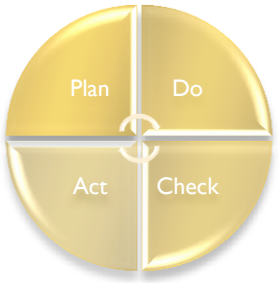


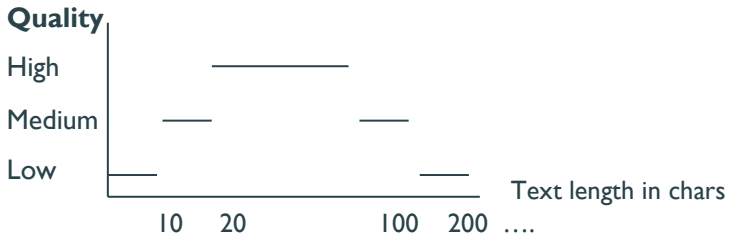
Quality improvement process



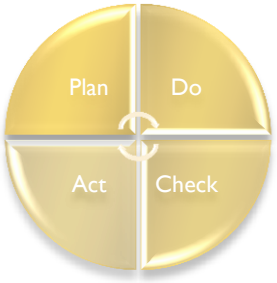
Quality improvement process

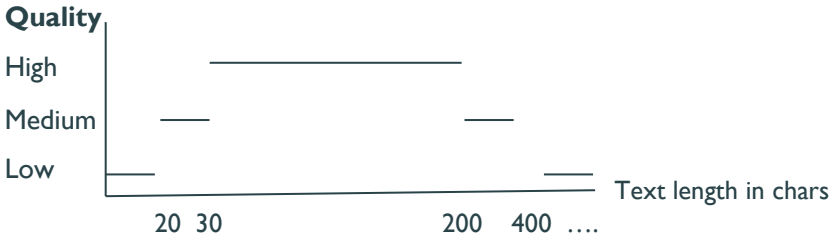
User requirement



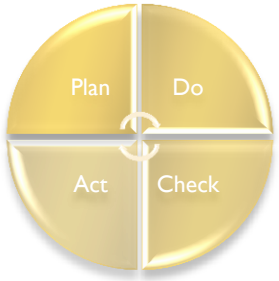


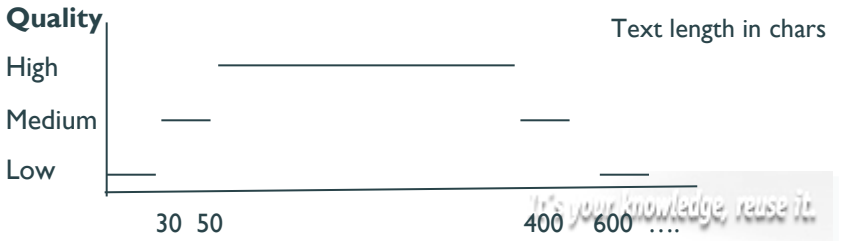
System requirements





Component requirements

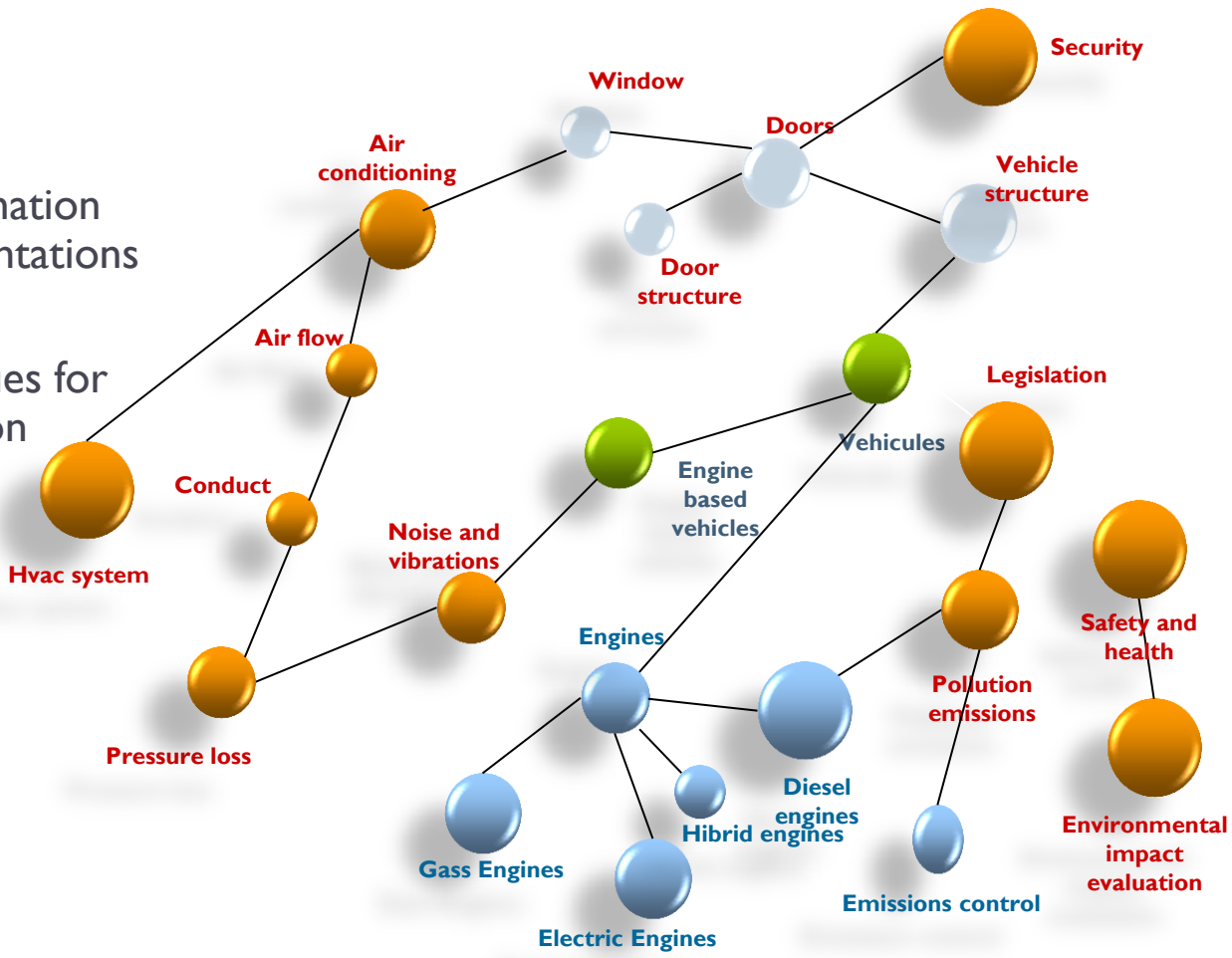




RQA Semantics

RQA makes use of:

- Requirements transformation towards formal representations
- Ontologies
- High level NLP techniques for enhancing transformation



Requirements formal representation

- Semantic graphs: an example

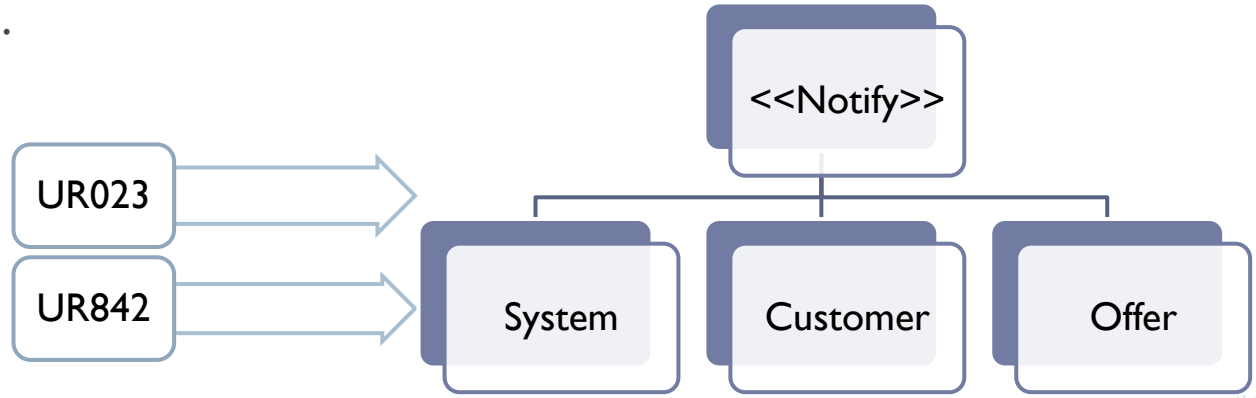
UR001: ….

UR023: The system shall send weekly notifications to the customers including our offers

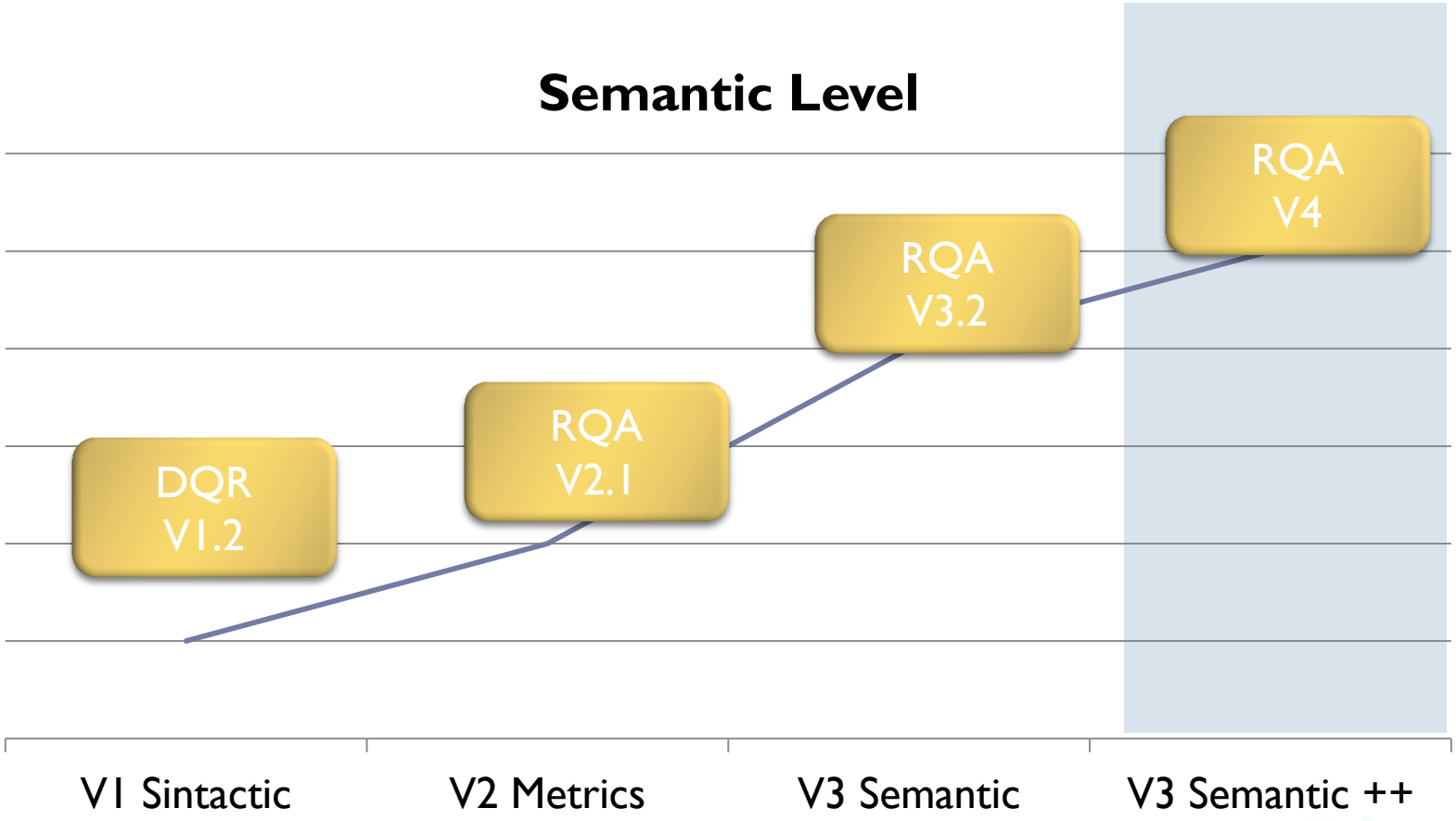
URxxx: …

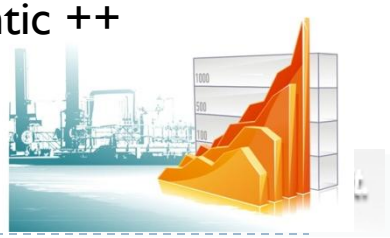
UR842: The application shall be able to notify periodically all of our offers to our clients

UR999: …



The near future of RQA

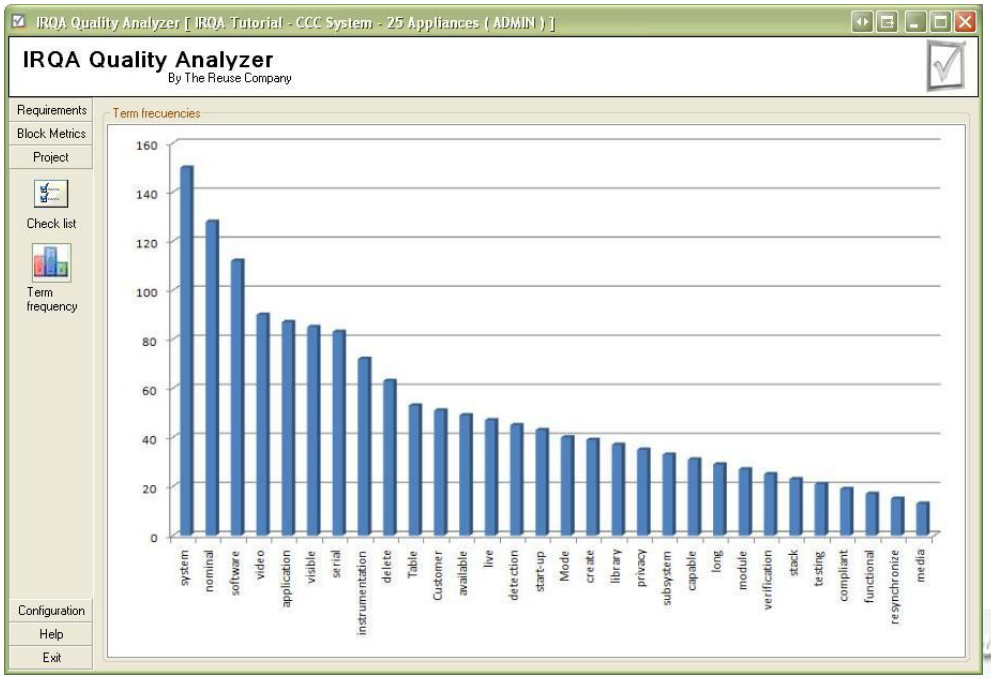




The near future of RQA

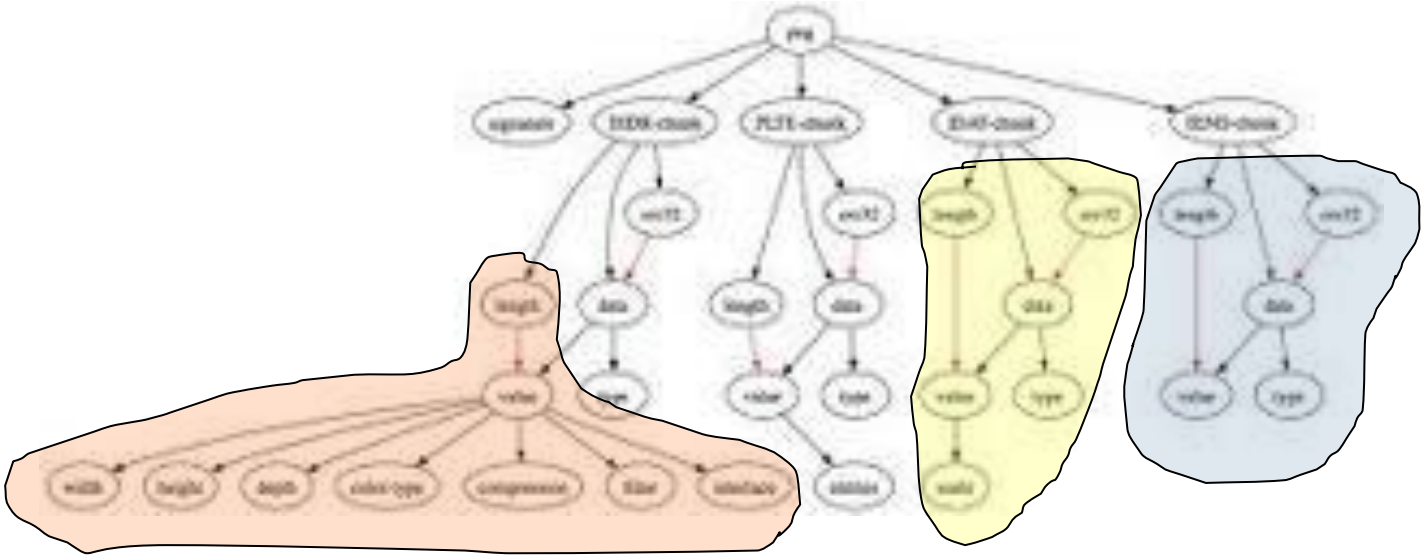
- Most frequent concepts and actions:
  - The list of most frequent terms arises the conceptual model out of the requirements specification
    - Counting occurrences by the same term regardless singular-plural, masculine-feminine…
    - Using synonyms due to the fact that different terms could have the same meaning (concept)
  - Harvesting of actors,

    classes, use cases,..



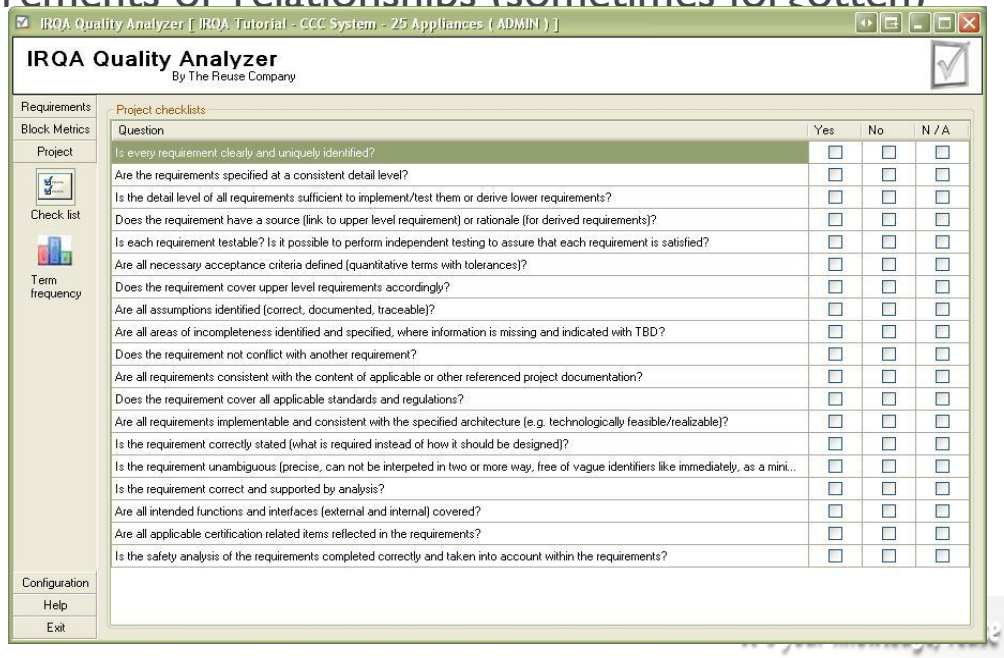
The near future of RQA

- Domain Coverage Degree / Non explicit domain terms:
  - Those terms that appear in our domain, but not in our specification
  - % of specification terms covered by the domain model family
  - Are we missing something in our specification?



The near future of RQA

- Global checklists will soon be shared among projects
  - Customized checklists
    - Created by the QA // Assigned to every project by PM // Filled by any Analysts
  - Including some actions that must be done or checked
  - Including different kinds of requirements or relationships (sometimes forgotten)

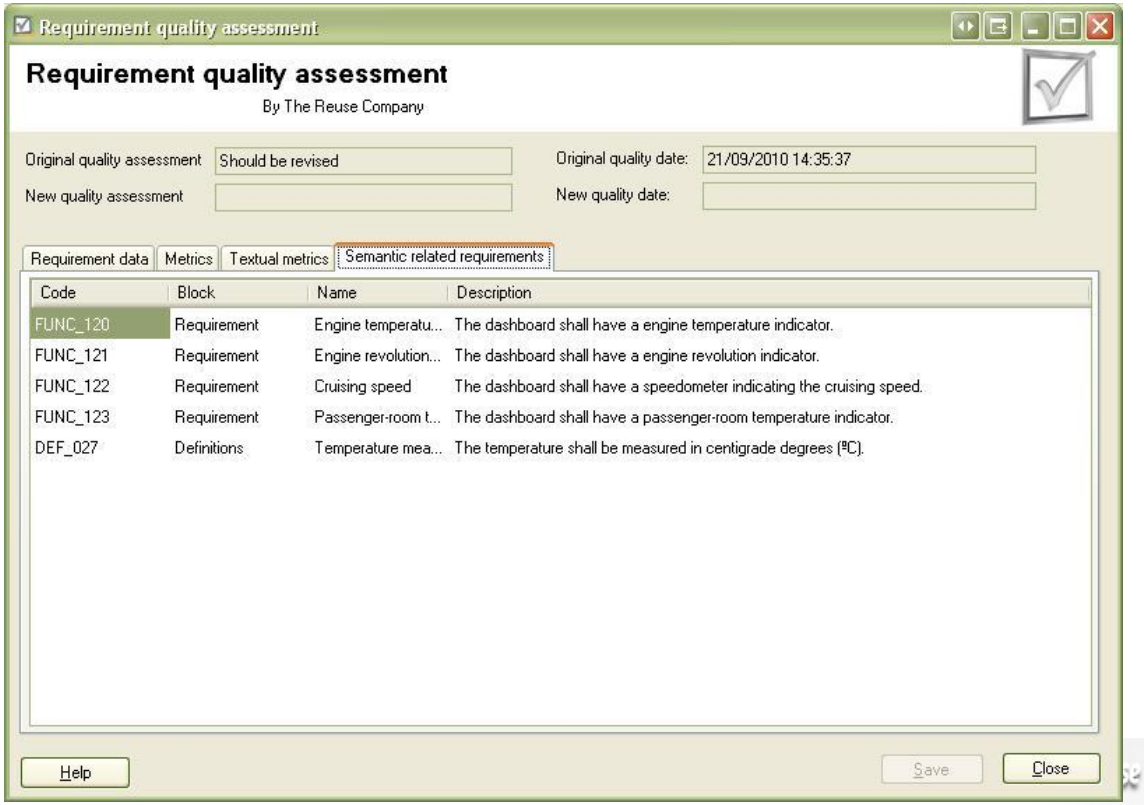


The near future of RQA

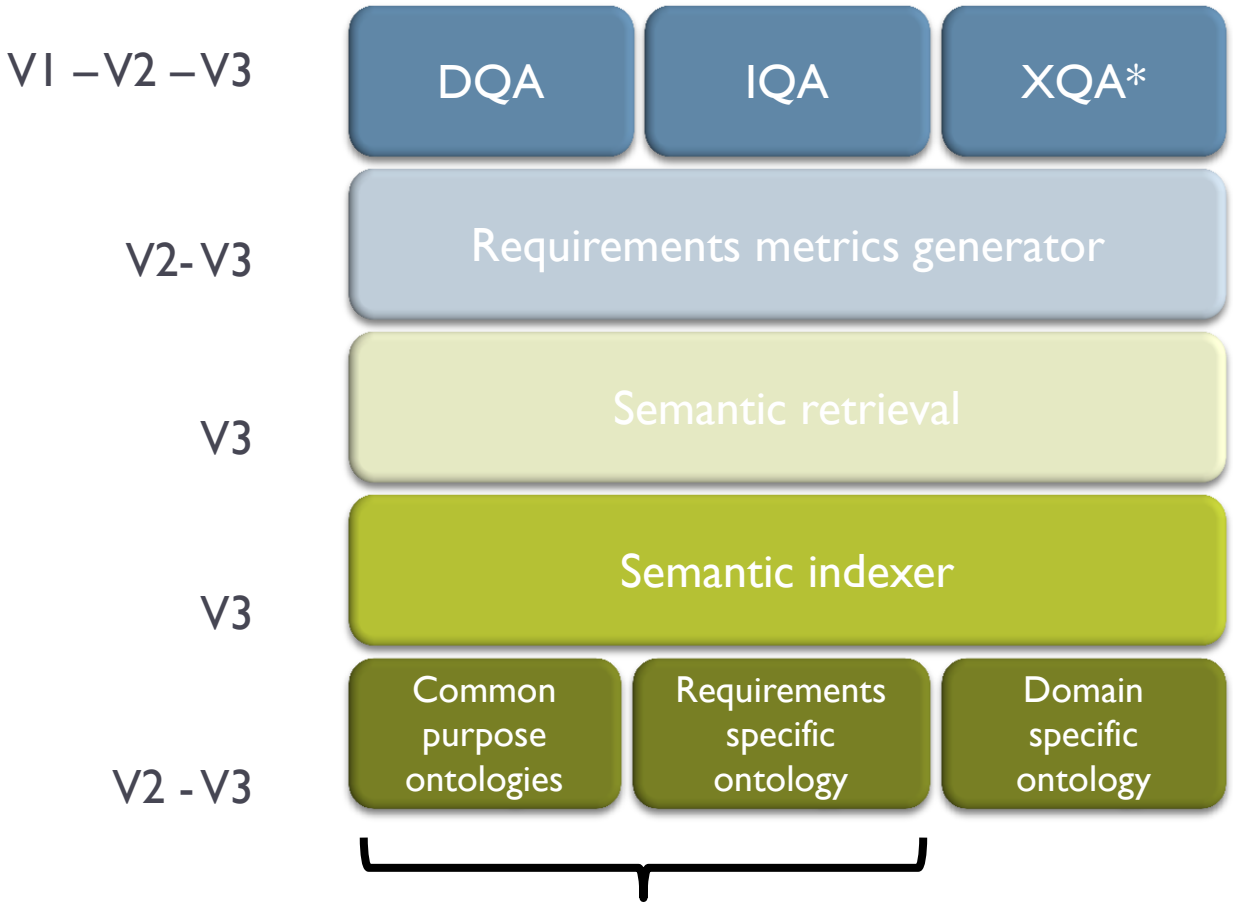
- Ambiguity Suggestion system
  - Several valid expressions are suggested once an ambiguous term is detected
- Requirements Hierarchy shape:
  - How does parent-child relationship appear in the document?
- Requirements editor:
  - Based on standard grammars
  - Based on some common actions
  - Based on your own domain terms
  - Fully customizable

The near future of RQA

- Semantically related requirements
  - Semantically related requirements given a particular one



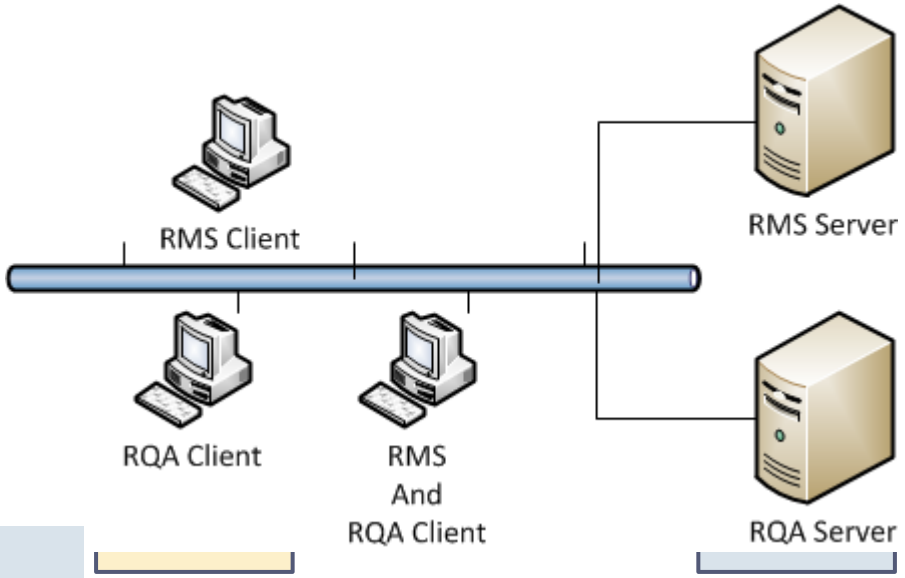
Architecture and Software Environment



RQA operating architecture

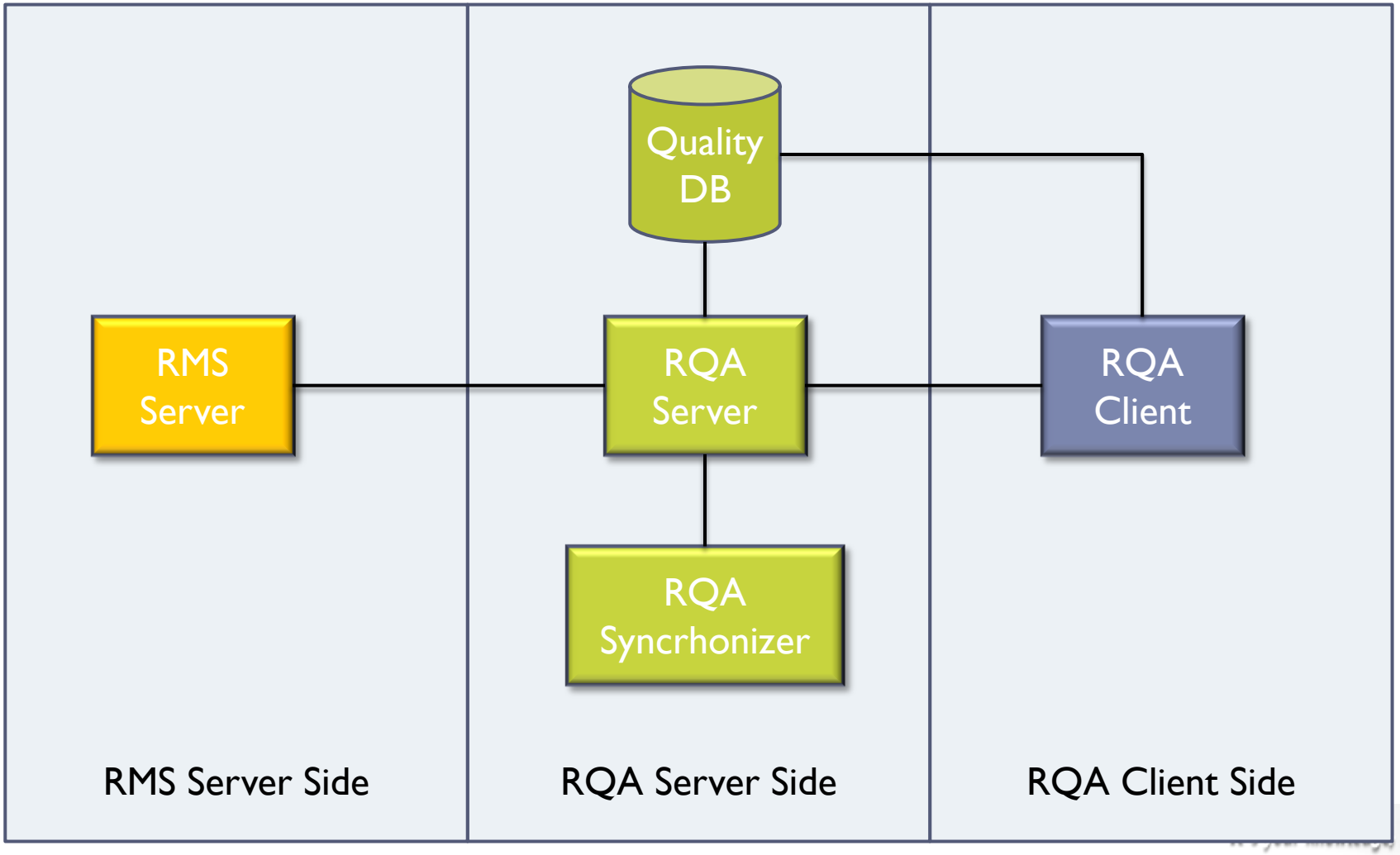
- Project based operating environment

- **Client:**
  - Windows XP, Vistas or Windows 7
  - .Net Framework 3.5 sp.1



- **Server:**
  - Windows 2003 Server or 2008 Server
  - .Net Framework 3.5 sp1
  - SQLServer 2005, SQLServer 2008 or MS Access

RQA Architecture and Software Environment



What RMS does RQA support

DOORS

DQA Product

IRQA

IQA Product

MICROSOFT EXCEL (2Q2011)

XQA Product

Requirements Quality Analyzer

- Further information about Requirements Quality Analyzer:
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  - http://www.reusecompany.com

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