Mastering CPRE®

- ✓ Explained in simple language
- ✓ Fully aligned to IREB syllabus v2.2
- ✓ Accompanied with a 200 questions question bank

LN Mishra CPRE, CBAP, CSM, SPOC

World-wide convener

Open Requirements Engineering Group

www.Open-RE.org

Mastering CPRE

Acknowledgements and Bibliography

Syllabus for CPRE Foundation Level examination, IREB, Germany

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Preface and Introduction

As the book title suggests, this book is a guidebook for the aspirants of the CPRE examination from IREB, Germany.

We value your time and hence the book is designed to be extremely specific – Help you pass the certification examination with least possible effort.

This book is authored by a qualified CPRE trainer who has helped many other participants clear the CPRE examination in the very first attempt. He is also trainer for CPRE preparations in both corporate and public workshops and have trained thousands of participants across the world – USA, Australia, Middle East, South East Asia, Europe and Africa.

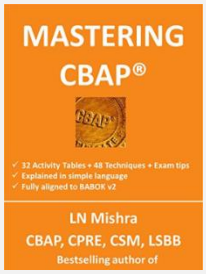
The book will soon be followed by an exhaustive question bank and audio book to further assist participants.

Feedbacks and suggestions on the book

We will be glad and thankful if you can share your feedbacks and suggestions on the book. Please your feedbacks and suggestions to LNMishra@AdaptiveProcesses.com

About the Author

LN Mishra (LN) has 22 years of professional experience in software product development, requirements analysis, business analysis, governance, risk and compliance management (CMMI, ISO9001, ISO27001, HIPAA and Six-Sigma).



LN is a practicing requirements engineer and business analyst for more than 15 years. He was involved in multiple multi-country large ERP implementation projects. He currently consults in development of 2 large systems - one of the largest paint companies in the world to develop their next generation color management system and development of a GRC system. He is also the product manager for an enterprise Governance, Risk and Compliance management system (GRCPerfect) which is operational in multiple client places.

He was involved in one of the world's change management program in PricewaterhouseCoopers, a leading management consulting firm, in one of the largest privatization effort in India for a public sector utility agency.

LN has conducted more than 100 workshops, both public and in house in the areas of Business Analysis, Requirements Management, Agile Project Management, software Project

Management, Six Sigma, CMM, ISO 9001 and ISO 27001. He has also guided 30+ six sigma green belt projects in iGate, MACH and Akzo Nobel.

LN holds a Post Graduate Diploma in Management (PGDM) from IIM Ahmedabad, the too-most business management school in India and Bachelor in Engineering (Honors) in Electronics and Telecommunication from University College of Engineering, Burla, India.

Major Awards/Recognitions:

- ✓ Certified Requirements Engineering Professional (CPRE) from IREB, Germany
- ✓ Certified Business Analyst Professional (CBAP) from IIBA, Canada.
- ✓ Certified Project Management Professional (PMP) from PMI, USA
- ✓ Certified Scrum Master from Good Agile, USA
- ✓ World Topper Certified software Quality Analyst (CSQA), 2000
- ✓ Certified Lead Auditor for ISO 9001, ISO 27001, ISO 20000 and BS 25999

Clients for whom LN has consulted and mentored

LN lives with his wife, Ananya, son, Siddharth and daughter, Saianshee in Bangalore, the IT capital of India.

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1. All about CPRE

What and Why of CPRE

CPRE stands for Certified Professional in Requirements Engineering, a certification provided by International requirements Engineering Board (IREB), Germany (www.IREB.org). This is the most widely acknowledged certification for requirements engineers. There are more than 20000 requirements engineering professionals certified in CPRE Foundation Level examination world-wide.

Following are some of the benefits of becoming a CPRE

- ✓ Be recognized for your competency in requirements engineering.
- ✓ Requirements engineering is a growing career opportunity for IT professionals.
- ✓ Stakeholders with domain experience can join IT sector by becoming requirements engineers.
- ✓ Better job prospects.
- ✓ Better salary.

What is IREB?

International requirements Engineering Board (IREB) was founded in Germany in to support the requirements engineering community by:

- ✓ Creating and developing awareness and recognition of

the value and contribution of the requirements engineers.

- ✓ Providing a forum for knowledge sharing and contribution to the requirements engineering profession.
- ✓ Publicly recognizing and certifying qualified practitioners through an internationally acknowledged certification programs such as CPRE – foundation Level, CPRE-Advanced Level and CPRE-Expert Level.

Prerequisite for CPRE

The only formal prerequisite for admission to the Foundation Level Exam is having a valid identity card or passport. Please take your ID document to the exam for proof of identity. For answering the exam questions correctly, you need to know the content of the defined Foundation Level syllabus. Taking a training course is not a requirement for admission to the test but is recommended by the IREB.

Preparation

One can prepare for the exam

- ➢ By attending a CPRE training with a training provider. The training should take at least three days and be conducted by a training provider recognized by IREB.

- ➢ By preparing individually in self-study.

- By downloading the practice exam from IREB.org. The practice examination contains 34 questions in the same format as the live examination. Additionally to the questionnaire the download contains solutions and correction aids as well.

- By having a look at the exam regulations for the Foundation Level. Please notice the regulations regarding negative scoring for incorrect answers!

Certification examination

The exam takes 75 minutes. In this time, one has to answer 45 multiple choice questions. The questions are of differing difficulty and therefore assigned differing amounts of points. The exam is closed-book, i.e. no materials are allowed to be used. To pass the exam, one must achieve at least than 60% of the total score possible. The exam is conducted by a licensed certification body. The exam can be taken in Chinese (Mandarin), Dutch, English, French, German, Spanish and Portuguese (Brazil).

Examination results

Exam results are checked by the certification body. Results are dispatched to the personal address stated on the application. If one has passed the exam, one will receive the certificate together with the results. If one takes the exam online, one gets the results right after the

examination. The certificate is delivered via post. The certificates achieved via online exam are dispatched within the same period of time the results of conventional exams are sent.

2. Introduction and foundation

2.1. Symptoms of and reasons for inadequate RE

Need for good requirements engineering

As per a study by TechRepublic (http://www.techrepublic.com/blog/tech-decision-maker/study-68-percent-of-it-projects-fail/), it is estimated that around 68% of projects fail due to poor requirements engineering. Majority of customer expectation mismatches can be attributed to poor requirements.

Hence, it is extremely essential that we focus on identifying and documenting complete requirements for all projects.

As per the TechRepublic study mentioned above, two third of system errors in production are due to requirements errors. Developers develop solutions as per their understanding of requirements. Unclear, incomplete, or wrong requirements lead to development of wrong solutions.

Complete and correct requirements are the basis for successful system development. Discovering gaps in requirements early avoids tedious change control processes.

Costs of requirements error fixing

Costs of fixing requirements defects usually increase exponentially with each passing project phase. For instance, the effort to fix a requirements defect is up to 20 times higher if the correction is done during programming as opposed to fixing the same defect during requirements engineering phase. If the defect is fixed during acceptance testing, effort involved may be 100 times higher. This is especially true of non-functional requirements as non-functional requirements tend to affect system architecture more than functional requirements.

Before we delve into why poor requirements are developed, let us understand "Requirements" first.

Defining requirements

IEEE defines requirements as:

- ✓ A condition or capability needed by a stakeholder to solve a problem or achieve an objective.
- ✓ A condition or capability to be met or possessed by a solution or solution component to satisfy a contract, standard, specification, or other formally imposed documents.
- ✓ A requirement may be unstated, implied by or derived from other requirements, or directly stated and managed. One of the key objectives of requirements engineering is to ensure requirements are visible to and understood by

all stakeholders.

Requirements describe, but not limited to, past, present and future conditions or capabilities in an enterprise, organizational structures, roles, processes, policies, rules and information systems. Requirements should be at the level of depth necessary for clarity and implementation.

A domain is the area undergoing analysis, boundaries of an organization and external stake-holders and their interactions.

Defining requirements engineering

Requirements engineering is a systematic and disciplined approach to the specification and management of requirements with the following goals:

1. Identifying relevant requirements,
2. Achieving stakeholder consensus on requirements,
3. Documenting requirements according to given standards and
4. Manage requirements systematically.

Source: [Rupp, Klaus Pohl and Chris 2015]

Requirements engineers analyze and synthesize information provided by customers, staff, IT professionals and executives. They elicit the actual needs of stakeholders, not simply capture their expressed desires. Requirements engineering activities may be performed in many job titles or organizational roles.

Requirements engineering practitioners include requirements engineers, business systems analysts, systems analysts, product managers, product owners, enterprise analysts, business architects, management consultants and interaction design professionals.

Symptoms of poor requirements engineering

Key symptoms for inadequate requirements engineering are:

- ✓ System not used,
- ✓ User dissatisfaction with developed system,
- ✓ System not meeting stakeholder needs,
- ✓ Features needed by stakeholder not needed getting implemented.
- ✓ Work executed though workarounds.

Causes of poor requirements engineering

Most common reason for poor requirements are:

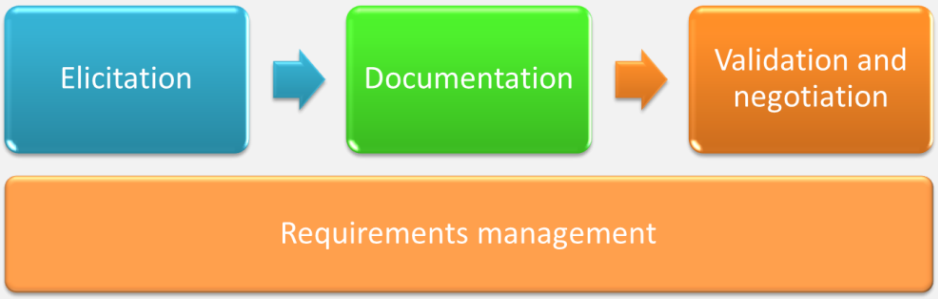
- ✓ Assumption that requirements are obvious and hence need not be stated explicitly,
- ✓ Improper communication from stakeholders to business

analysts and then to designers and developers,

- ✓ Tendency to begin design and coding to speed-up the project implementation without proper requirements gathering,
- ✓ Inadequate time allotted for requirements engineering,
- ✓ Lack of appropriate skills for requirements elicitation,
- ✓ Inadequate templates available for requirements elicitation,
- ✓ Inadequate level of detailing needed for solution requirements.

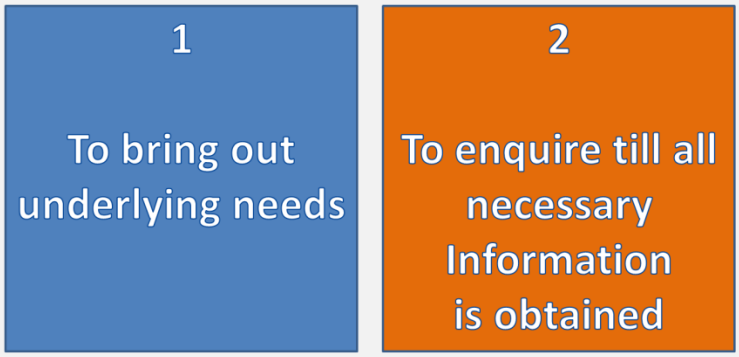
Please watch a very interesting video on problems with requirementshttps://www.youtube.com/watch?v=FqkQrPmsP2w

2.2. Four major activities of requirements engineers



Elicitation

Elicitation means to "Understand underlying needs" and "To draw forth - to enquire till all necessary information are obtained".



Key objectives for elicitation are:

- ✓ Elicit requirements from stakeholders and other sources using different elicitation techniques.
- ✓ Elicit various attributes of requirements.

Documentation

Key objective for documentation is to document elicited requirements correctly reflecting stakeholders needs.

Validation and negotiation

Key objective for Validation and negotiation is to ensure documented requirements meet requirements quality criteria.

Requirements management

Requirements management is an ongoing activity which spans across all other requirements activities, such as elicitation, documentation and validation.

Key objectives for requirements management are:

- ✓ Manage requirements from creation till decommissioning of requirements,
- ✓ Prioritize requirements,
- ✓ Structure requirements,
- ✓ Manage requirements changes.

Source: [Rupp, Klaus Pohl and Chris 2015]

Different levels of requirements

Requirements are usually provided at 3 levels: Business, Stakeholder and System.	
Requirements classification	**Description**
Business requirements	Higher-level statements of needs, goals or objectives, why a project has been

	initiated; its objectives, metrics, needs of the organization as a whole. For example: Adaptive to introduce trainings for global customers.
Stakeholder requirements	Needs of a particular stakeholder or class of stakeholders and how they interact with a solution. A bridge between business requirements and solution requirements. For example, requirements from Trainer: An web-based platform to conduct web-based training.
Solution requirements	Characteristics of the solution that meets business requirements and stakeholder requirements. Categorized into be functional and non-functional. **Functional requirements** describe behavior and information that the solution will manage, capabilities that the system will be able to perform in terms of its behaviors or operations, specific IT application actions or responses. Typically linked to business processes or operations that the organization manages. - Must provide video, audio and text based interaction between trainer and

	participants. - Must have provision for both online and off-line interactions. **Non-functional requirements,** also known as ***quality or supplementary requirements***, capture environmental conditions under which the solution must remain effective, or qualities that the systems must have rather than the behavior or functionality of the solution. For example, requirements related to capacity, speed, security, availability, information architecture and UI presentation. - Must have availability of more than 99.9% time for the workshop duration.
Transition requirements	Capabilities needed to facilitate transition from current state of the enterprise to a desired future state, but not be needed once the transition is complete. These requirements are temporary in nature and cannot be developed until both an existing and new solution are defined. Typical transition requirements include data conversion from existing systems, skill gaps to be

	addressed etc. - Training of trainers on the new web-based platform. [Source: Business Analysis Body of Knowledge, IIBA Canada, v2.0]

2.3. Role of communication in requirements engineering

Natural languages are the most common and important means to communicate requirements. However, stakeholders understand natural language requirements differently due to their knowledge and background. Natural language communication effectiveness depends on familiarity of stakeholders on the subject, their past experiences, cultural and educational backgrounds, etc.

Hence, it is important to develop common terminology (glossary) and defined requirements constructs, i.e. describe requirements using a standard structure, while communicating in natural language. Expressing requirements using standard constructs helps in not forgetting essential information while using natural languages.

Requirements engineers can take help of modeling languages such as Unified Modeling Language (UML) and Business Process Modeling Notation (BPMN) which reduces ambiguity in communication using natural language.

[Rupp, Klaus Pohl and Chris 2015]

Impact of communication mediums in requirements engineering

> Communication mediums (written or spoken) have significant effect in requirements communication (or miscommunication). When communicating in natural languages, all stakeholders **MUST** consciously focus on direct and simple communication. In verbal communication, success of the communication relies on expressed language, gestures and feedbacks. But in written communication, these are absent. Many often, requirements may be communicated incorrectly due to natural transformations that occur during human perceptions
>
> [Rupp, Klaus Pohl and Chris 2015]

2.4. Skills of requirements engineers

Responsibilities of requirements engineers

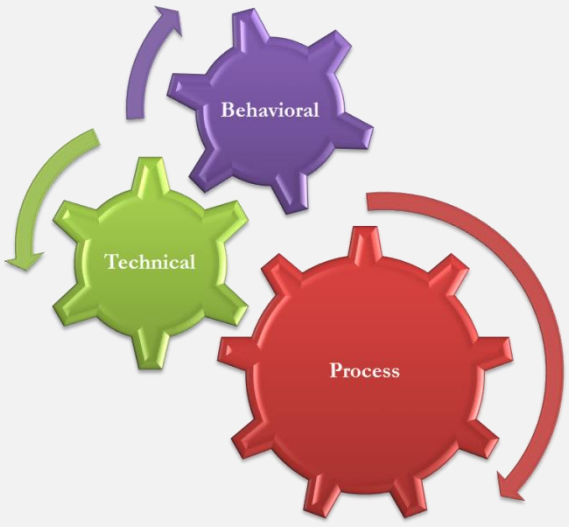
Before we understand skills for requirements engineers, it is essential to understand responsibilities for requirements engineers. Following are the key responsibilities for requirements engineers:

- ✓ Understand business domain as well as technology domain,
- ✓ Act as the connecting links between business stakeholders and technology implementation stakeholders,
- ✓ Plan requirements engineering activities in collaboration with stakeholders,
- ✓ Speak the language of the stakeholders,
- ✓ Be able to communicate requirements (e.g., by means of diagrams and graphs),
- ✓ Create requirements documents,
- ✓ Maintain respectful relationships with stakeholders,
- ✓ Present ideas and alternatives as well as their realizations,
- ✓ Make systems user-friendly and simple,
- ✓ Ensure systems satisfy functional and non-functional requirements,
- ✓ Plan and organize requirements communications,
- ✓ Take additional responsibilities towards Domain SME,

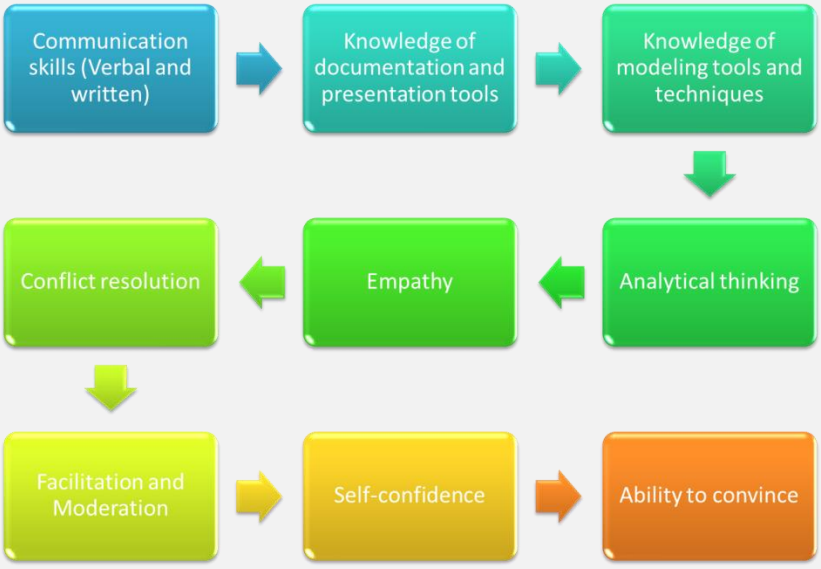
Project Manager and Tester if needed.

Skills of requirements engineers

Requirements engineer is a key project role. Usually they are the **ONLY** ones who are in contact with all the stakeholders, from sponsor, to Domain SMEs and Implementation SMEs. Requirements engineers need more than only requirements engineering process knowledge. 3 key skill areas for REs are behavioral, process and technical.



Requirements engineers **MUST** acquire following skills:



Communication skills

Good communication skills are essential to elicit requirements and communicate them in a suitable manner. Requirements engineers must be able to listen, ask right questions at right time, notice when a statement does not contain desired information and make further inquiries when necessary.

Knowledge of documentation and presentation tools

Requirements engineers MUST become familiar with documentation and presentation tools.

Knowledge of modeling tools

Requirements engineers MUST become familiar requirements modeling tools and techniques. Requirements modeling

techniques help in reducing requirements ambiguity.

Analytical thinking

Analytical thinking allows requirements engineers to group and analyze requirements at the right level.

Empathy

Empathy for stakeholders helps in building personal connects with stakeholders.

Conflict resolution skills

Conflicts are common during requirements engineering. They could be due to differing opinions among stakeholders with respect to value, priority of requirements. Requirements engineers **MUST** identify and record conflicts and use suitable techniques to resolve conflicts.

Moderation / Facilitation skills

Requirements engineers must be able to mediate between different opinions and lead discussions during individual and group conversations. They should anticipate problems that might arise in such situations and act accordingly.

Requirements engineers **MUST** be able to represent requirements in different fora. They **MUST** consolidate differing opinions, facilitate a decision in case of disagreements and create consensus among the stakeholders.

Self-confidence

Requirements engineers are exposed to criticisms as well. Requirements engineers need high level of self-confidence and should have the ability to defend themselves. They should NEVER take criticism personally.

Ability to convince

Requirements engineers should be able to convince stakeholders the need to prioritize requirements as per agreed upon criteria and need for realizing maximum value from requirements in shortest possible time.

2.5. Three(3) types of requirements

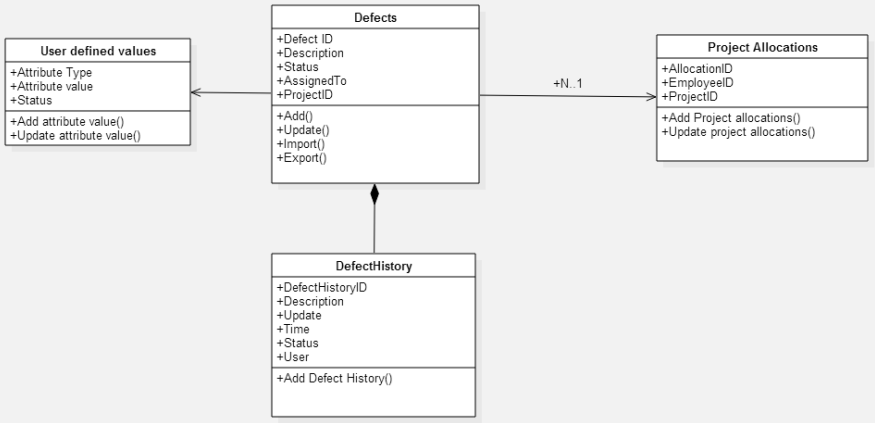
Functional requirements

Functional requirements (FRs) describe abilities of a system that are important to user community. These are functionalities offered by the system. Sample examples of functional requirements are "Manage customer", "Manage order", "Manage employees" etc.

Categories of functional requirements are:

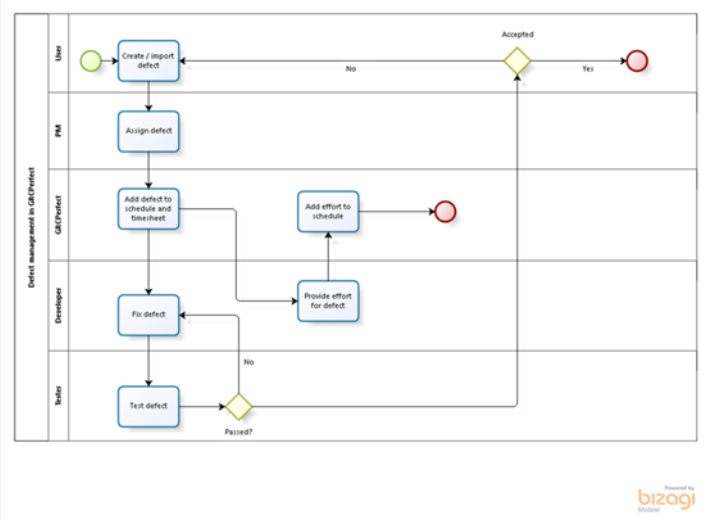
Data perspective: (Data)

In the data perspective, data aspects are described.



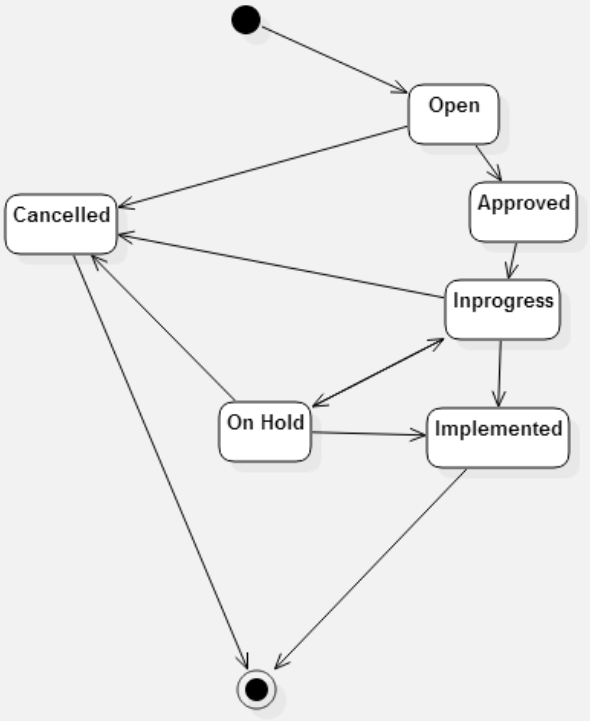
Functional perspective: (Logic)

Functional perspectives describe data flows or logic flows of the system.



Behavioral perspective:(State)

In the behavioral perspective, statuses of data elements are described.



Non-Functional (Quality, Supplementary) requirements

The umbrella term "non-functional requirement" is often used for quality requirements and constraints. Quality requirements describe qualities of a system that are important to:

- ✓ User community, such as usability, learnability, reliability, etc.
- ✓ Development community, such as scalability, maintainability, reusability, etc.

Quality requirements often influence the system architecture more than functional requirements do. Quality requirements must be documented explicitly. Quality requirements should be traceable to business needs and other requirements. Include appropriate measures for NFRs to be testable.

Quality requirements are mostly documented using natural language.For example:

- ✓ 90% of users shall be able to use basic functions of the system within 6 hours of training.
- ✓ The system shall provide 90% of responses in less than 5 seconds.

Performance

Time taken to perform activities and resource utilization levels.

Security

Ability to ensure appropriate confidentiality and integrity of information, to verify when actions were taken and by whom and to authenticate users.

Reliability

Measure of application being available when needed. Includes ability of the application to recover from errors, uptime, or failures in interfaces.

Usability

The system being usable by target audience with specified duration of training.

Maintainability

Ability to change one component without affecting others and without causing unexpected failures, ability to re-use components and testability.

Portability, also known as Transferability

Ease of installing and uninstalling the application, different environments it can run and ease of migrating it to a new environment.

A useful mnemonic: **CRM POST (Compatibility, Reliability, Maintainability, Performance efficiency, Operability, Security and Transferability)**

Constraints

Constraints are aspects which project team cannot influence or modify. (e.g., “The system shall be implemented using .net”) or the time frame (“The system shall be available by fourth quarter of 2015”). Constraints are not implemented; they are adhered to. Constraints limit the solution options (which is actually a good thing else we will have large number of solution options to deal with). Constraints influence requirements engineering planning, execution and techniques.

In addition to the above classifications, requirements may be classified based on requirement attributes, such as the levels of detail, priorities, or legal obligations.