



ETICS
The Grid Quality Process

A Quality Certification Model for Grid Research Projects

the ETICS feasibility Study

Adriano Rippa

(adriano.rippa@eng.it)

- Engineering Ingegneria Informatica s.p.a.

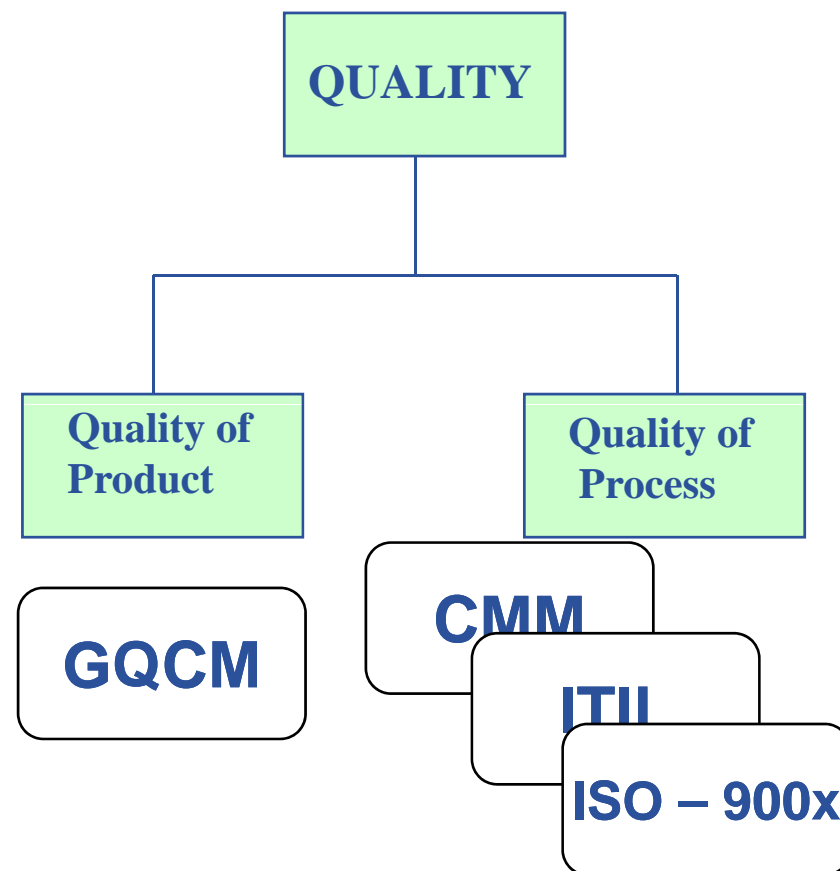
On behalf of ETICS Project

www.eu-etics.org



- Introduction to QA concepts
- The starting point of the present study
- The proposed **Grid Quality Certification Model (GQCM)**
- Comparing GQCM and other QA standards
- Using GQCM in Industries: the Engineering experimentation
- Conclusions

- **Quality of the implementation process**
 - High level steps of the software production cycle suggesting what the organization must do (not how) to have effective development processes that “*may lead*” to good software.
- **Quality of the requirements management**
 - Correct collection/management of requirements and relation with the customer and stakeholders, to reduce the percentage of failures due to misinterpreted requirements.
- **Quality of the service**
 - Performances and correctness of the service provide
- **Finally quality of the software...**



- **Measure:** a value (number or category) assigned to an attribute of an entity (e.g. software component)
- **Measurement:** The act or process of assigning a number or category to an entity to describe an attribute of that entity.
- **Metric:** A function whose inputs are software measures and whose output is a single numerical value that can be interpreted as the degree to which software possesses a given attribute that affects its quality.

- **State-of-the-art provide hundreds of measures**
 - The most common
 - Cyclomatic complexity
 - Lines of Code
 - Function Points
 - Mean Time Between(to) failure
 - Bugs density
 - ...
 - Other approaches (Goal Question Metric - GQM) promote user defined metrics
 - Anomalies distribution
 - Effort used to solve anomalies
 - Cost of not founded anomalies
 - ...

- There are **many standards** to assess the quality of the processes of an organization
 - CMM
 - ISO family
 - ITIL
 - AQAP
- But QA means initial investments and managing QA means devote resources to it!
- Several studies show that lot of companies (e.g. many Small/Medium Enterprises) **can't afford the initial effort** and don't recognise the promised **increase of value**.

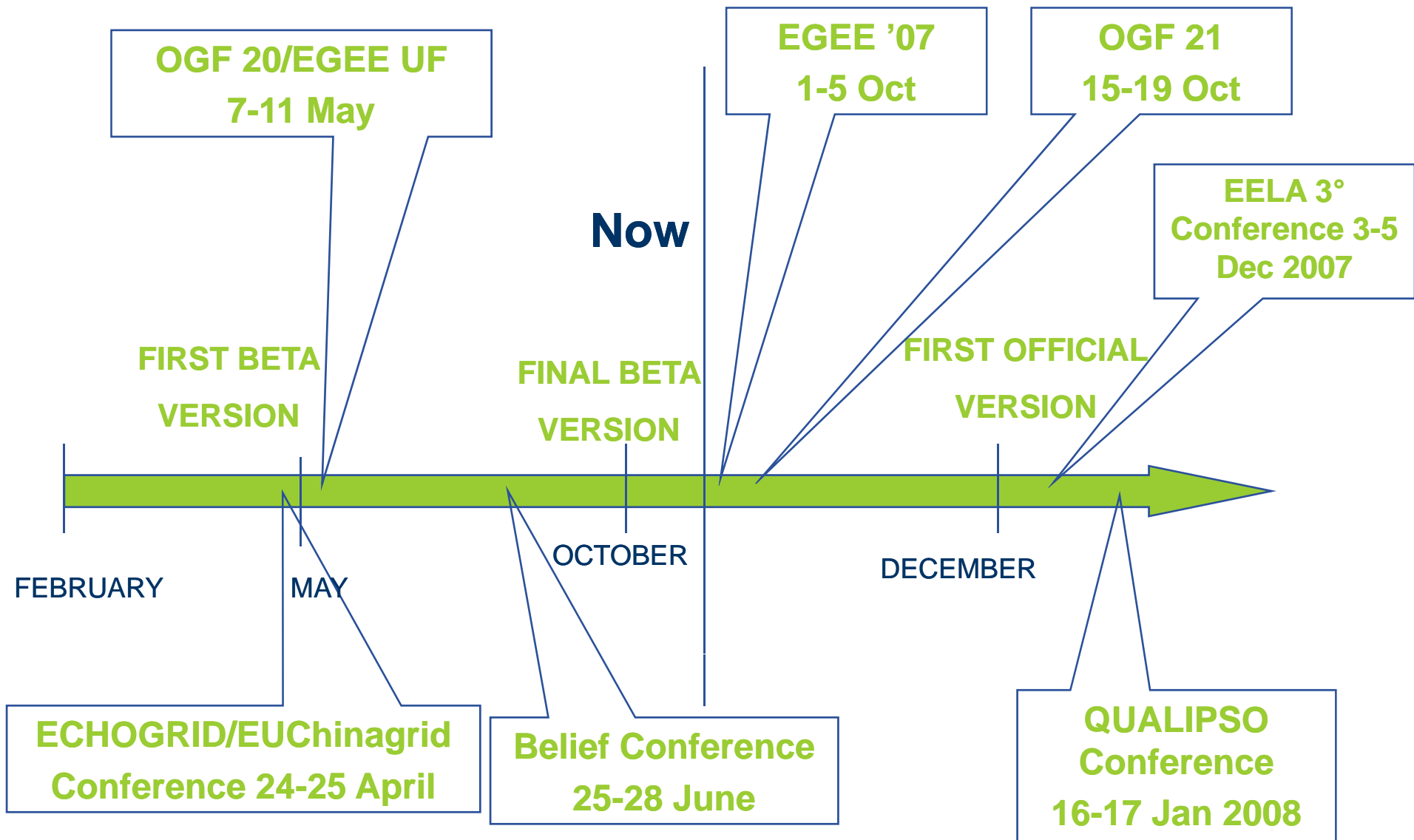
- **CMM-I levels:**
 - 1 Initial: Processes are low managed and controlled. There is a first tentative to look at the quality
 - 2 Managed: Processes are specific, controlled, applied, replicable
 - 3 Defined: There is homogeneity in the processes between all the projects. They are defined by the organization
 - 4 Quantitatively Managed: Processes are measured and controlled
 - 5 Optimising: Focus on the continuous improvement process

- **Only ~70 companies in the world are certified at level 5**
 - 50 of them are in India

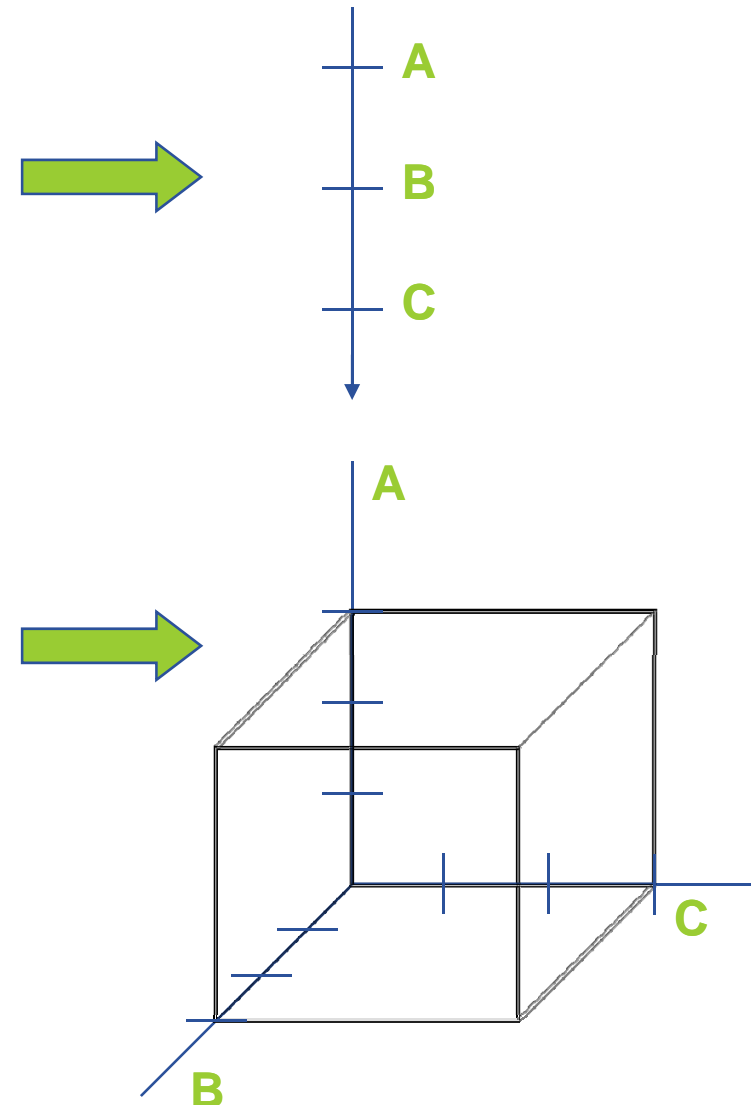
- **Only 25% of the companies in the world are level 2 or above**

- **Current quality assurance standards are useful but**
 - They are **process oriented**, the organisation need to be structured and certified. What for the short-live consortia?
 - They **provide only theoretical guidelines** that need to be adapted and realised
 - It's **hard to systematically verify goodness** of results: managing tools needed
 - They **need resources** to be devoted to.
 - **People need to be trained** and certification needs **inspections and time to be achieved** (usually about two or three years depending on the organisation complexity).

- **GQCM is a model for quality assurance that is**
 - **fully automatable** in measuring and verifying activities to reduce investments and management effort,
 - **not subjective**, to certify the object not the process nor the organization,
 - **product oriented**, not process oriented,
- **...easily adoptable within grid Research Projects**



- **Some QA Standards are**
 - Waterfall-like
 - Boolean
- **GQCM could be seen as a model that looks at the quality by independent points of view, tested separately to provide user-friendly results**



- GQCM is **independent** from the ETICS tools
- Any GQCM implementation needs just **“automation”** !
- GQCM has been developed and described according to several ISO standards (e.g. ISO/IEC 25000, 14598) and will be experimented in a ISO/CMM certified organization

- **GQCM is structured in Evaluation Modules (EM).**
- **The set of evaluation techniques are grouped in families. Every family is an EM**
- **5 EMs:**
 - EM: Static analysis
 - EM: Coding style
 - EM: Structural testing
 - EM: Functional testing
 - EM: Standards compliance

- **EM Static analysis**

- Quality characteristics:
 - Reliability – maturity
 - Maintainability – analysability
 - Maintainability – changeability
 - Maintainability – testability
- Technique:
 - Static analysis of classes. Statistics on measures are used as predictor of quality characteristics. This analysis is expected to be supported by an analysis tool.
- Applicability:
 - Object oriented programming languages.
- Input:
 - source code, each class of the code is analysed

- **EM Coding style**

- Quality characteristics:
 - Maintainability – analysability
- Technique:
 - Static analysis of the source code. This analysis is expected to be supported by an analysis tool.
- Applicability:
 - Most programming language
- Input:
 - source code

- **EM Structural testing**

- Quality characteristics:
 - Functionality – accuracy
 - Reliability – maturity
- Technique:
 - Structural testing. The intention of this EM is to test specific classes that are identified by static measures as being statistically more likely to have many errors.
- Applicability:
 - Object oriented programming languages
- Input:
 - source code

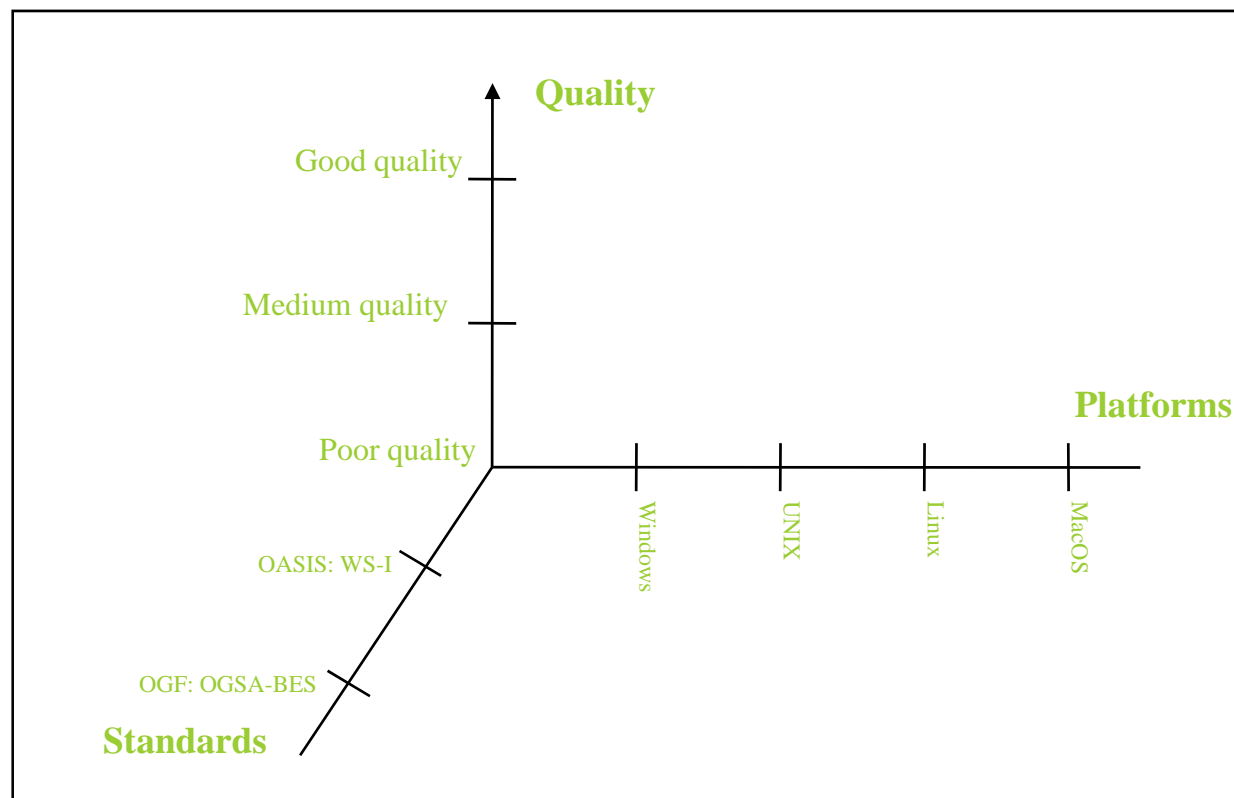
- **EM Functional testing**

- Quality characteristics:
 - Functionality – accuracy
 - Functionality – interoperability
 - Reliability – maturity
 - Portability – adaptability
 - Portability - installability
- Technique:
 - Functional testing
 - *The purpose of this EM is both to check platform compliance and to check to functional abilities of the software product.*
- Applicability:
 - General
- Input:
 - compiled code
 - user documentation

- **EM Standards compliance**
 - Quality characteristics:
 - Functionality – standards compliance
 - Technique:
 - Functional testing
 - *This EM has a good potential for automating the test.*
 - Applicability:
 - Standard specific
 - Input:
 - compiled code

- Testing results could be virtually grouped in three summarizing points of view to have a more direct vision of what is evaluated :

- Quality
- Platforms
- Standards



- **Final score should be provided according to the following schema. The items which should be available for the users are:**
 - A **table summarizing the results**
 - A **list of passed and non passed tests**
 - All the **important information** as:
 - Software product (e.g. name, version, executable code, documentation..)
 - Platform (name, version, date)
 - Quality characteristics (name, evaluation result, evaluation module identification)
 - Standard compliance (for each standard: name, version, date)
 - Identification of evaluation report (organization, report number, date)
 - Identification of certification body (organization, contact information)
 - Certification data (dates, certification number)
 - Electronic signature of certification record

	EMStatic	EM Coding	EM Structural	EM Functional	EM Std compl.
Functionality			X	X	
Accuracy			X	X	
Interoperability				X	
Compliance					(X)
Reliability	X		X	X	
Maturity	X		X	X	
Maintainability	X	X			
Analyzability	X	X			
Changeability	X				
Testability	X				
Portability				X	
Adaptability				X	
Installability				X	

	Consolidated eval. result	EM Static	EM Coding	EM structural	EM Functional	EM Std compliance
EM eval. result	M	M	G	G	G	Y
Functionality	G			G	G	
Accuracy	G			G	G	
Interoperability	G				G	
Compliance	Y					(Y)
Reliability	M	M		G	G	
Maturity	M	M		G	G	
Maintainability	M	M	G			
Analyzability	M	M	G			
Changeability	M	M				
Testability	M	M				
Portability	G				G	
Adaptability	G				G	
Installability	G				G	

G = Good
M = Medium
P = Poor

- **I can't add any overhead to my project**
 - This model (and the capability of automate) will reduce the effort in performing continuous build and test activities (e.g. coverage tests) on different releases
- **How much costs adopting it?**
 - Nothing, the model will be discussed publicly and the final version will be released under open license (e.g. Creative Commons)
 - The ETICS framework is provided as a service running on a dedicated infrastructure, free of charge for Research Project
- **My organisation is certified ISO/CMMi so I...?**
 - See next slides...
- **Other? Please criticise...**

- **Facts:**

- ISO 9126 define quality attributes
- GQCM support the measure and evaluation of quality metrics

- **Hypothesis:**

- ISO9126 Portability: adaptability, installability
 - ISO9126 asks OS adaptability and installability for software of certified organizations
 - GQCM may test deployment of SW on different platforms (HW+OS)
- ISO9126 Maintainability: all.
 - ISO9126 asks to develop a software that is easy to analyse, easy to modify, Stable
 - GQCM metrics (such as the CK for OO or coding conventions metrics) helps to verify in concrete these requirements

- **ISO9126 Functionality: accuracy.**
 - ISO9126 asks that a software have to give results according with requirements.
 - GQCM certification can run functional test (or plug-in external test suits) of declared compliances.
- **ISO9126 Functionality: adequacy.**
 - ISO9126 asks for correct functions with specific goals.
 - GQCM may check not dead functions.
- **Our thesis:**
 - Many ISO9126 quality metrics can be measured and evaluated based on GQCM
 - Any tool implementing it and can be integrated as supporting ISO9126 adoption

- **Facts**

- CMM is process oriented (it gives guidelines).
- GQCM is product oriented.

- **Hypotesis:**

- CMM2
 - asks to “control and value”
 - GQCM proposes the measures and metrics to be collected, hence controlling and evaluating specific sw related items
- CMM3
 - asks to “use internal standards and have a reference model”
 - GQCM proposes code and implementation conventions (how to organise and structure code, how to define tests, etc.)

- **CMM4**

- asks to “have measured and controlled processes using quantitative and statistical techniques”
- GQCM proposes the continuous collection of quality data to perform trends analysis.

- **CMM5**

- asks to have an “improvement process and quality based on measurement”
- GQCM provides numerical reference to set the improvement processes.




- **Our Thesis**

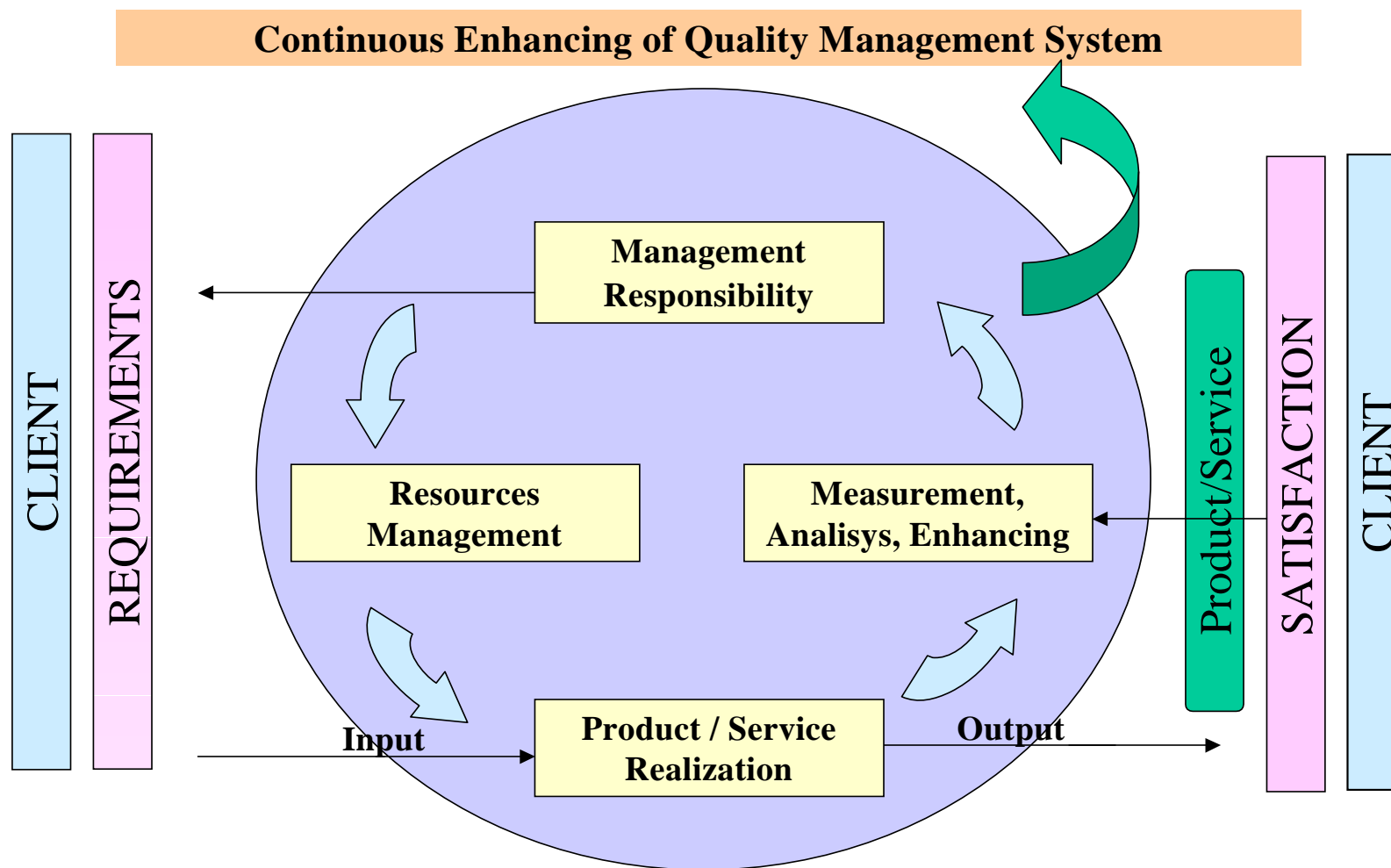
- GQCM is not in contrast with CMMI and can be integrated in organization as a tool to support CMMI adoption

- **All this work is born from internal needs of**
 - The research area
 - The production area
- **Engineering is certified as follows:**
 - ISO 9001
 - For all the ICT sector in which the organization is involved
 - Since 1994 (ISO9001:2000 from December 2002)
 - CMM 2
 - Since February 2005
 - For all production divisions
 - NATO AQAP 2110/160
 - Since December 1996 (from 1996 to 2005 there were different rules)
- **The company is managing the process to be certified at level 3**

- **To reach the level 3 we are selecting tools for test and quality management**
- **Engineering is developing Spago4Q**
(www.spago4q.org)
 - integrated with other tools measure processes, performances and bugs.
 - Examples of calculated metrics:
 - Test Coverage
 - Anomalies distribution
 - Effort used to solve anomalies
 - Cost of not founded anomalies
 - Metrics about requirements
 - Metrics about risk management
 - ...

- **GQCM + ETICS b&t tool will help to measure the left quality aspects as:**
 - The quality of the code
 - The compliance with standards
 - The compliance with OS
 - ...

- **Engineering looks at:**
 - Client satisfaction
 - Company success
 - Monitoring of the previous points 
- **Client satisfaction is seen as a necessary assumption to confirm and enhance Engineering's success** 
- **The way to obtain it is the supply of quality products** 
- **Engineering has a Quality Management System (QMS) defined pursuing the following principles:**
 - Client-oriented attitude
 - Continuous improvement
 - Focus on process
 - Involvement of all human resources



based on UNI EN ISO 9001:2000 processes

- **Engineering's Quality Management System:**
 - involves the entire organizational structure
 - operates on processes
 - adopts procedures
 - uses resources

- **Activities to reach the quality**

- identification, formalization, verification and filing of reference documentation (contractual and technical)
- drafting a Quality Plan, a document listing project requirements, the operational and management choices aiming at the implementation of requirements
- development in conformity with outlined production process
- verification of intermediate and final results (concerning in particular the design, testing activities and documentation)
- evolution management, during the different job phases and releases, of software and documentation;
- check-ups of monthly work progress compared with the actual project planning;
- formalization of project's main events, through recurrent technical and work in progress meetings with the Client.

- **At the beginning of the project, the Project Manager should draft a “Quality Plan” that handle:**
 - *Contractual documentation analysis*
 - must be clear that the Project Manager has understood and verified all aspects concerning the contractual relationship with the Client
 - *Project organization*
 - defined in terms of
 - *Resources*
 - *Roles*
 - *Responsibilities*

- *Product/service supply and project requirements*
 - description on:
 - *product/service to be supplied*
 - *product/service's requirements*
 - *resolutions in case of eventual vagueness*
 - *evidence of possible divergences compared to the contractual documentation*

- *Projecting and Development Process*
 - the adopted process, used methodology, output, support tools

- *Configuration Management*
 - what it has been decided for check of work-status of product components, for its back-up procedures

- *Suppliers' Management (sub-contractors) and interactions with Third Parties*
 - only in presence of sub-supplies, even if internal

- *Materials to be delivered/activities to be carried out*
 - all objects/materials to be delivered to Client or the activities to be carried out for the Client

- *Verifications and validations modes.*
 - projecting and development verification (functional and technical);
 - validation of function projecting and development

- **Quality Assurance and Internal Auditing Division has the responsibility:**
 - to verify the execution of targeted activities to eliminate possible anomalies arisen
 - to identify, describe and execute corrective actions in order to eliminate anomalies' causes
 - to identify, describe and carry out preventive actions in order to eliminate possible anomalies' causes
 - to undertake any initiative which could improve the effectiveness and efficiency of the Quality Management System

- **On an annual basis, this division drafts reports on details gathered by the different corporate divisions, regarding the fulfilment of Quality goals set at the beginning of the year, allowing the identification of possible improvements**
- **Control activities, on a periodical basis, carried out the Quality Assurance and Internal Audition Division within an IT project are classifies as follows:**
 - official check-ups
 - content check-ups
 - work -in progress check-ups
 - results' validation

- **GQCM is a certification model**
 - Automatable
 - Not in contrast with classical standards
 - Ready to be integrated with classical standards
 - Free
 - Not limited to the ETICS build and test tool
 - Not limited to research projects
- **GQCM require less human effort to be used because it is almost fully automatable**
- **ETICS tool is ready to implement GQCM**

- **We want it to be as simple and effective as possible to use. For this we need your feedback:**

ETICS-QAstudy@cern.ch

ETICS-discuss@cern.ch

ETICS-support@cern.ch



ETICS
The Grid Quality Process

<http://www.eu-etics.org>

- **Acknowledgements:**
 - **Many thanks for their contribution to**
 - **Daniela Vaghegini**
 - **Gabriele Ruffatti**
 - **Andrea Manieri**