

# Software Quality



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# Topics

- What is Software Quality?
- Why is it necessary?
- Types of Software Quality.
- How is it measured?
- CISQ's Quality Model.
- Functional Quality.
- SonarCloud.

# What is Software Quality?

# Definition (I)

*"Software quality is the degree to which a system, component or process meets the specified requirements and the needs or expectations of the customer or user." (IEEE, Std. 610-1990).*

# Definition (II)

*"Concordance of the software produced with the explicitly established requirements, with the prefixed development standards and with the implicit requirements not formally established, that the user wants" (Pressman, 1998)*

# Definition (III)

*"Quality is a complex and multi-faceted concept" (David Garvin 1987)*

# Garvin's Dimensions of Quality

- Performance
- Features
- Reliability
- Conformance
- Durability
- Serviceability
- Aesthetics or Style
- Perceived Quality



# Garvin's Dimensions of Quality

- Performance      Does software work as expected?
- Features
- Reliability
- Conformance
- Durability
- Serviceability
- Aesthetics or Style
- Perceived Quality



# Garvin's Dimensions of Quality

- Performance
- **Features**      Does software include additional features?
- Reliability
- Conformance
- Durability
- Serviceability
- Aesthetics or Style
- Perceived Quality

# Garvin's Dimensions of Quality

- Performance
- Features
- **Reliability**      Is software available when needed?
- Conformance
- Durability
- Serviceability
- Aesthetics or Style
- Perceived Quality

# Garvin's Dimensions of Quality

- Performance
- Features
- Reliability
- Conformance      Does software complies the standards?
- Durability
- Serviceability
- Aesthetics or Style
- Perceived Quality

# Garvin's Dimensions of Quality

- Performance
- Features
- Reliability
- Conformance
- **Durability**                      Can software be modified without bugs?
- Serviceability
- Aesthetics or Style
- Perceived Quality

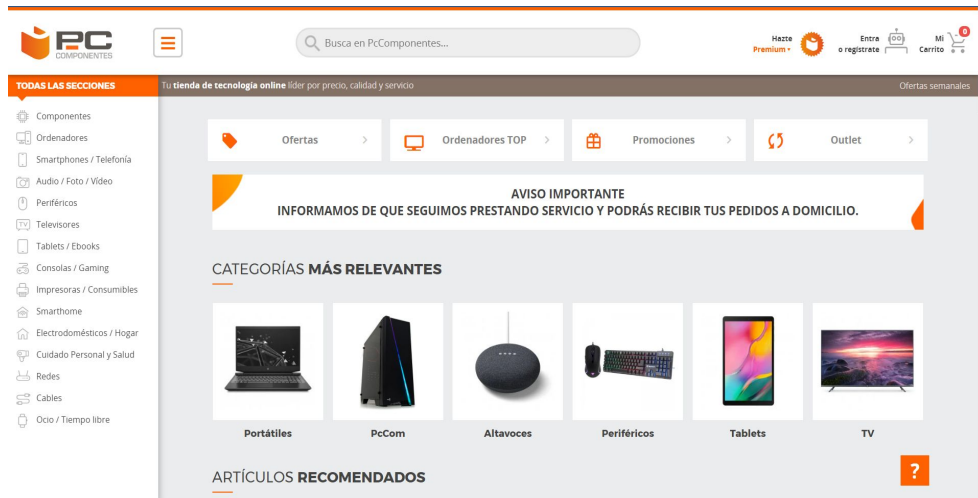
# Garvin's Dimensions of Quality

- Performance
- Features
- Reliability
- Conformance
- Durability
- Serviceability      Will product be on maintenance?
- Aesthetics or Style
- Perceived Quality

# Garvin's Dimensions of Quality

- Performance
- Features
- Reliability
- Conformance
- Durability
- Serviceability
- Aesthetics or Style      Is software engaging?
- Perceived Quality

# Aesthetics or Style



# Garvin's Dimensions of Quality

- Performance
- Features
- Reliability
- Conformance
- Durability
- Serviceability
- Aesthetics or Style
- Perceived Quality      Does developer have good reputation?



Why is Software Quality  
necessary?

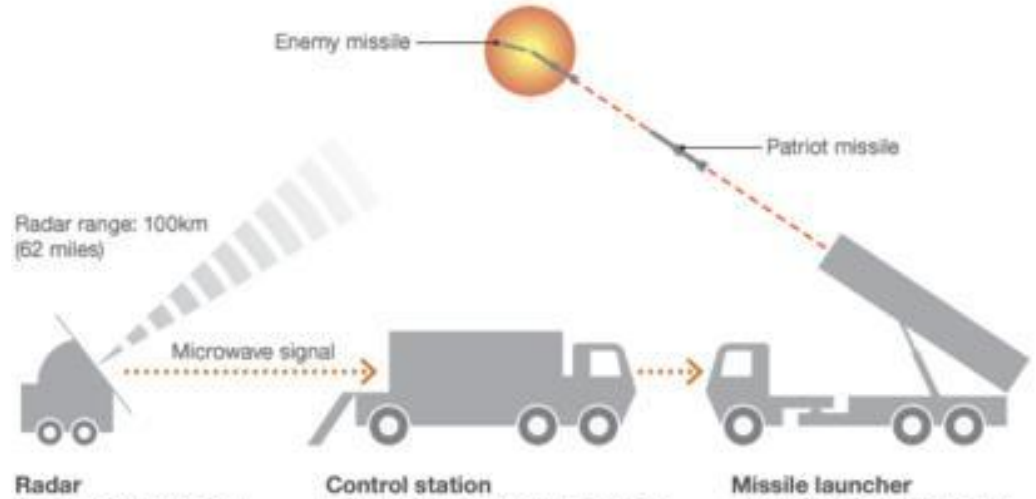
# History of Software Quality

*“Let’s stop wasting \$78 billion per year”. (CIO Magazine, 2001)*

Software Engineering. A Practical approach (Chapter 14)

# Risk management

- Loss of human life
- Loss of great amounts of money
- Patriot missile



# Cost management

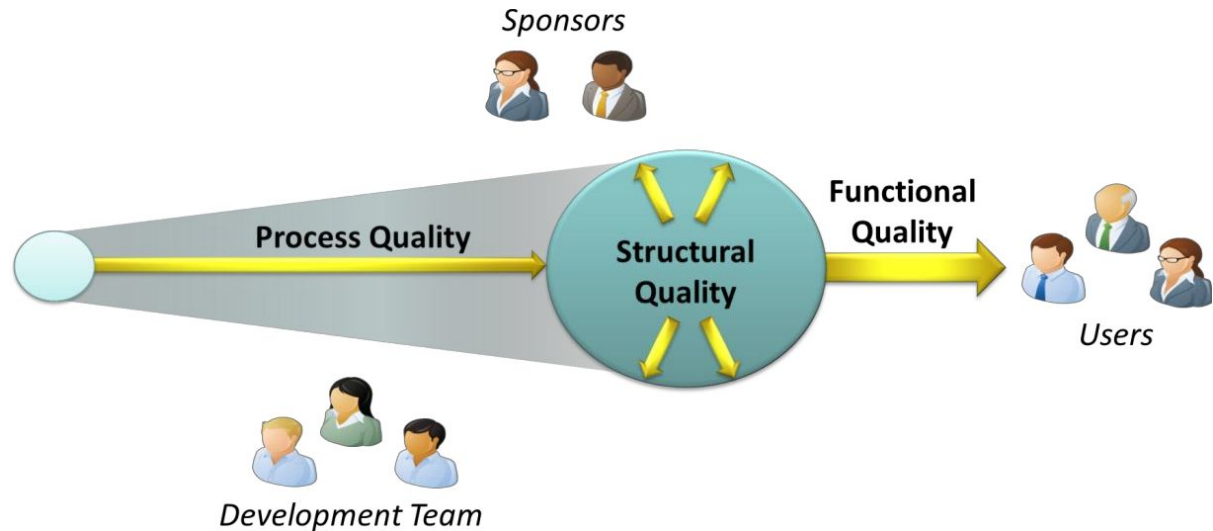
- Loss of money due to bugs fixing.
- Loss of time.
- 2000 year problem (Y2K).



# Types of Software Quality

# Notions of Quality

- Functional Quality
- Structural Quality



# Functional Quality

- Explicitly established functional requirements.
- User gratification.

**Does software include the specified requirements from the client?**

# Structural Quality

- Software maintainability.
- Intuitive User Interface.

**Does software follow an appropriate structure?**



# Dynamic and static evaluation

- Dynamic evaluation

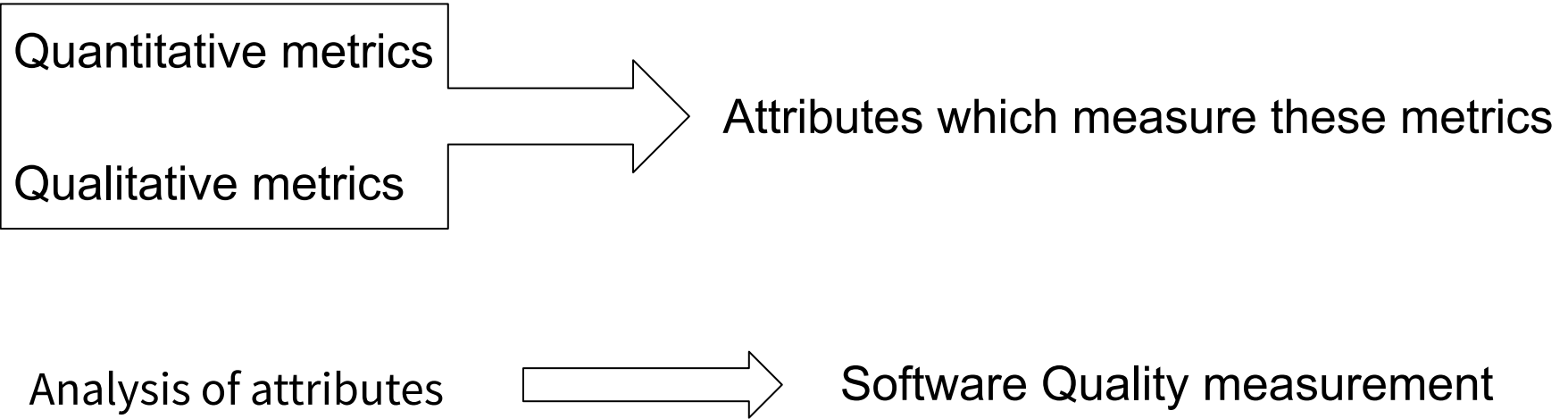
Software being tested while executed.

- Static evaluation

Software being tested by analyzing the structure

How is Software Quality  
measured?

# Metrics and attributes



# CISQ's Quality Model

# CISQ's Quality Model (I)

- Reliability
  - ❑ Non-compliance with good architectural and coding practices.
  - ❑ Mathematical estimate.
  - ❑ Both software and hardware are involved.
  - ❑ Error and exception handling.
- Efficiency
- Security
- Maintainability
- Size

# CISQ's Quality Model (II)

- Reliability
- **Efficiency**
  - ❑ Important in applications requiring high execution speed.
  - ❑ Appropriate response time.
  - ❑ Memory, network and disk space management.
  - ❑ Both software and hardware involved.
- Security
- Maintainability
- Size

# CISQ's Quality Model (III)

- Reliability
  - ❑ Input validation.
- Efficiency
  - ❑ Cross-site scripting.
- Security
  - ❑ Access control to programs.
- Maintainability
- Size

# CISQ's Quality Model (IV)

- Reliability
  - ❑ Modularity.
- Efficiency
  - ❑ Changeability.
- Security
  - ❑ Portability.
  - ❑ Documentation.
- Maintainability
  - ❑ Compliance with Object Oriented Programming
- Size



# CISQ's Quality Model (V)

- Reliability
- Efficiency
  - ❑ Technical sizing.
  - ❑ Functional sizing → **function point analysis**
- Security
- Maintainability
- Size

# Functional Quality

# Functional Quality (I)

- Unit Testing
- Integrity testing
- Functional testing

We have analyzed structural quality but...

**What about functional quality?**

# Functional Quality (II)

- Unit Testing
  - ❑ Test Driven Development
- Integrity testing
  - ❑ Does not ensure error-free software.
- Functional testing
  - ❑ Tests every function of the code.

# Functional Quality (III)

- Unit Testing
  - ❑ Behaviour Driven Development
- Integrity testing
  - ❑ Tests databases access and network requests.
- Functional testing

# Functional Quality (IV)

- Unit Testing
  - ❑ Need more time and maintainability.
- Integrity testing
  - ❑ Tests the Graphical User Interface.
- Functional testing
  - ❑ Allows developers to test software in different platforms.

# How to develop Quality Software?

**sonarcloud** 

# SonarCloud (I)

- What is SonarCloud?

Cloud service based on SonarQube.



# SonarCloud (I)

- What is SonarCloud?

Cloud service based on SonarQube.

- What is SonarQube?

Open source platform used to inspect software quality.

# SonarCloud (II)

- What can SonarCloud do?

- ❑ Inspect source code.
- ❑ Detect bugs and vulnerabilities.
- ❑ Detect security hotspots.
- ❑ Make a structural quality analysis, based on CISO's model metrics.

# SonarCloud (III)

- New metrics of SonarCloud

- ❑ Code smells.
- ❑ Debt.
- ❑ Cyclomatic complexity.
- ❑ Cognitive complexity.

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# References

-  [\*Software Engineering: A Practitioner's Approach - Roger S. Pressman\*](#)
-  [\*Software Quality\*](#)
-  [\*Functional Testing\*](#)
-  [\*Software Reliability\*](#)
-  [Software reliability testing](#)
-  [Confiability Calculation](#)
-  [What is Software Quality](#)
-  [\*SonarCloud\*](#)

# Thank you for your attention!

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[Software-quality](#)