

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

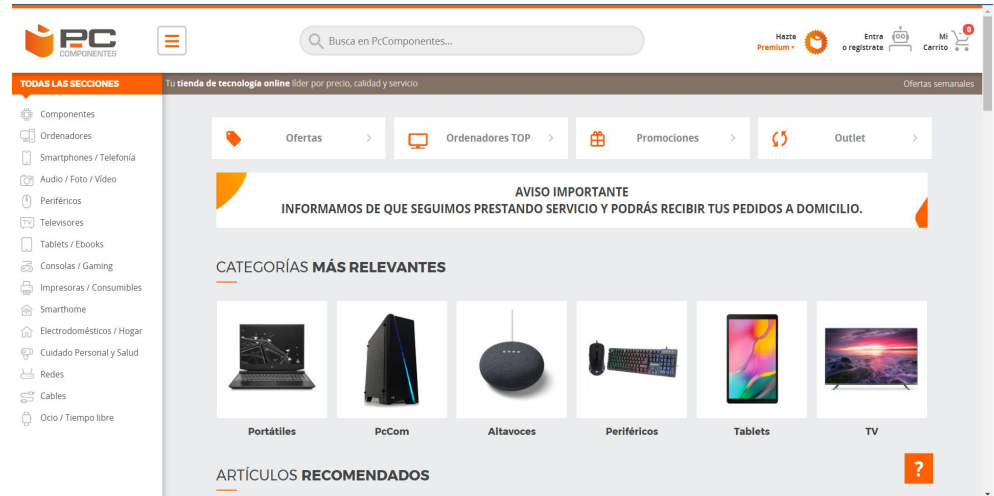
Garvin's Dimensions of Quality

- 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?

Perceived Quality



Why is Software Quality necessary?

History of Software Quality

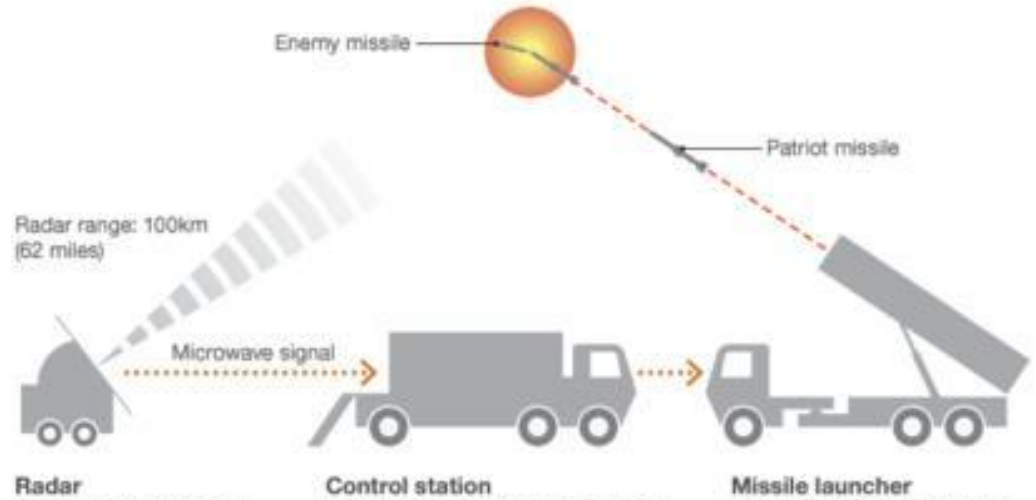
“Let’s stop wasting \$78 billion per year”

(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

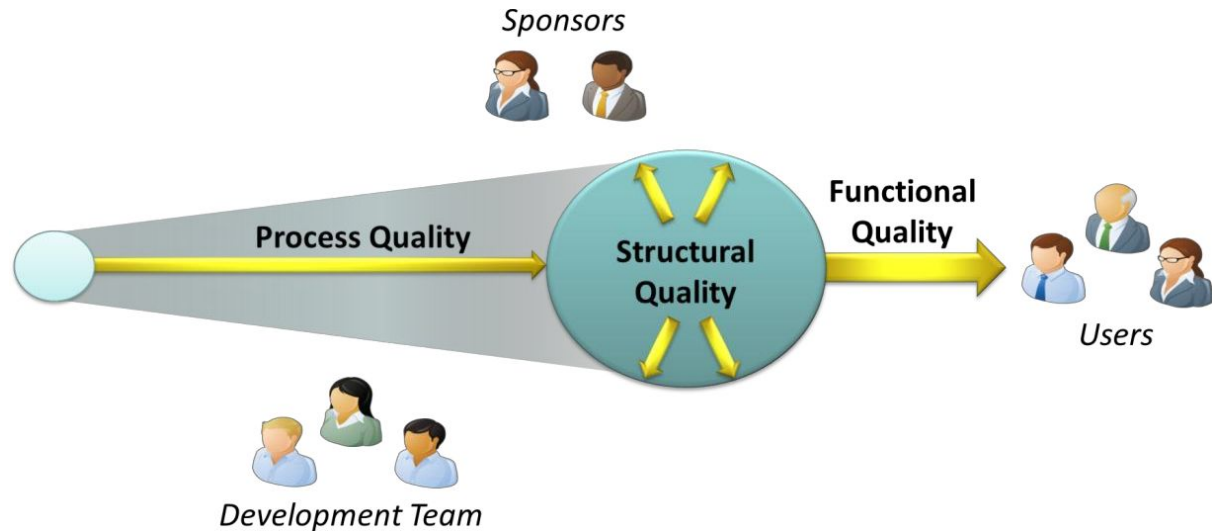
- Loss of money due to bugs fixing
- Loss of time
- 2000 year problem (Y2K)



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

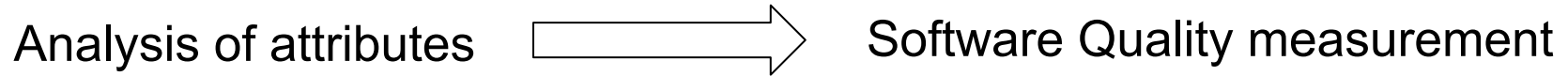
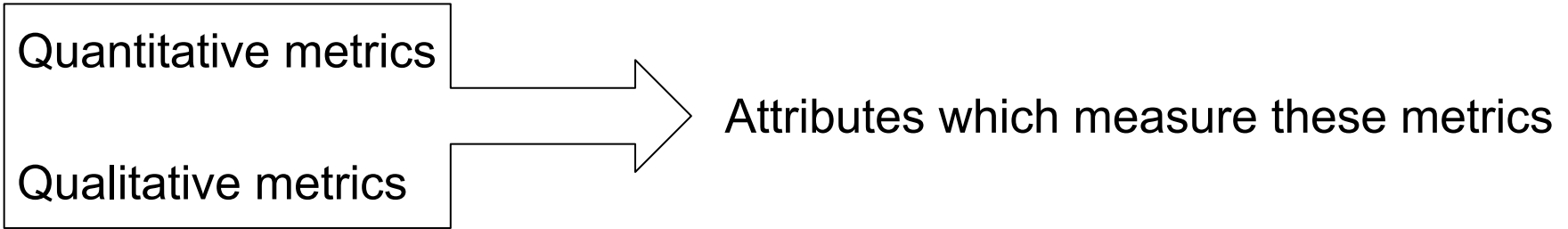
Software being tested while executed

- Static evaluation

Software being tested by analyzing the structure

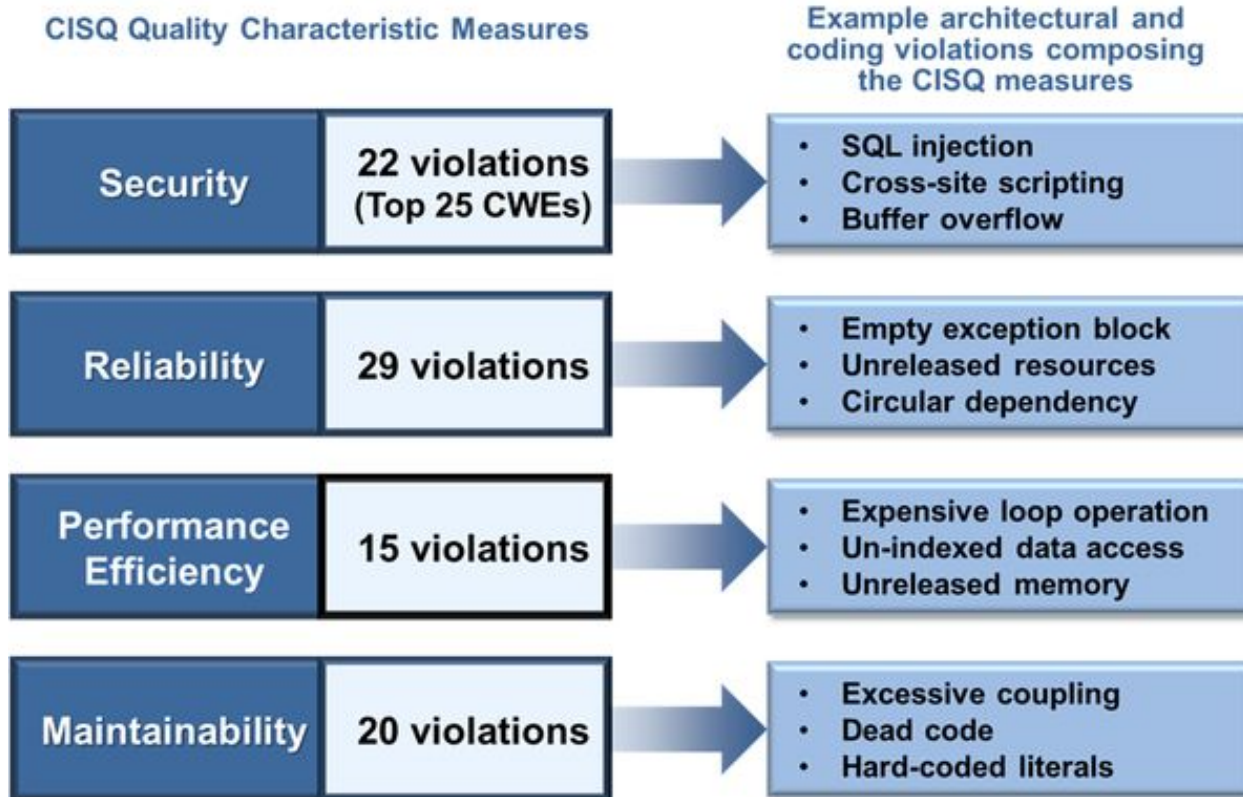
How is Software Quality measured?

Metrics and attributes



CISQ's Quality Model

CISQ's Quality Model



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
- Maintainability
 - ❑ Documentation
- Size
 - ❑ Compliance with Object Oriented Programming

CISQ's Quality Model (IV)

```
'use strict';

/** Clase que representa un tablero de ajedrez. Contiene las propiedades
 * y métodos necesarios para pintar un tablero de ajedrez en un Canvas.
 */
class ChessBoard {

    /**
     * @description Crea un objeto Point.
     * @param {number} size - Dimensiones del tablero.
     */
    constructor(size) {
        this.size = size;
        this.squares = []; // Conjunto de casillas del tablero
    }

    /**
     * @desc Obtiene el tamaño del tablero.
     * @return {number} Tamaño del tablero.
     */
    get boardSize() {
        return this.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 (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

SonarCloud (IV)

- New metrics of SonarCloud

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SonarCloud (V)

- New metrics of SonarCloud









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SonarCloud (VI)

- New metrics of SonarCloud

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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](#)