340CT
Software Quality and Process Management

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Architectural Patterns

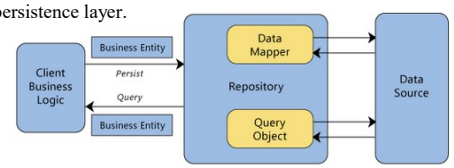
- Architecture design and patterns review
  - describes a fundamental and **structural** organization for software systems with a set of predefined subsystems
  - specifies the **relationships of subsystems**, and include the **rules & guidelines** for organizing their relationships
  - Examples: design patterns
    - Repository (layered architecture)
    - Publisher-Subscriber (event driven architecture)

Patterns: Repository – Review 1

- Repository pattern
  - Context: to deal with the problems with the applications where the **business logic requires accesses data from data stores**.
  - Solution: to use a repository to separate the logic that retrieves the data and maps it to the entity model from the business logic that acts on the model. A repository **separates the business logic from** the interactions with **the underlying data source.**

Patterns: Repository Review 2

- The repository **queries the data source** for the data, maps the data from the data source to a **business entity**, and persists changes in the business entity to the **data source**.
- A **separation between the database access and the application**: a Repository encapsulates the set of objects persisted in a data store and the operations performed over them in the persistence layer.



Source: The Repository Pattern (MSDN)

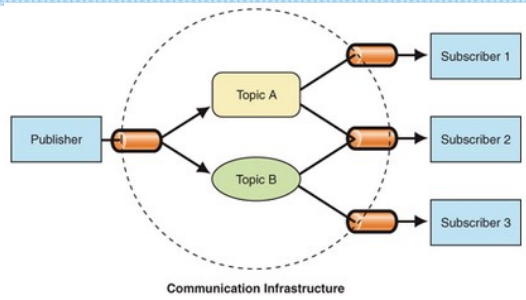
Patterns: Publisher-Subscriber 1

- Publisher-Subscriber pattern
  - Context: an integration architecture of several applications in which **an applications can send messages to the applications that are interested in receiving the messages** without knowing the identities of the receivers.
  - Solution: to set up communication infrastructure which creates a mechanism that **sends messages to all interested subscribers** and enables listening applications to subscribe to specific messages.

Patterns: Publisher-Subscriber 2

- Publisher-Subscriber pattern
  - **List-Based**: to identify a pre-defined subject and to maintain a list of subscribers for that subject. The subject notify each subscriber on the subscription list for an event.
  - **Broadcast-Based**: based on a pre-defined subject, all messages are sent to all listening nodes, and each node is responsible for filtering unwanted messages.
  - **Content-Based**: messages are intelligently routed to their final destination based on the content of the message.

Patterns: Publisher-Subscriber 3



Source: The Publisher-Subscriber Pattern (MSDN)

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Quality Attributes/Criteria 1

- Quality attributes review
  - Overall features of the architecture that affect **run-time behaviour, system design, and user experience**, such as: usability, performance, reliability, and security which indicates the success of the design and the overall quality of the software application.
  - When designing applications to meet any of these qualities, it is also important to consider the **impact on other requirements and the tradeoffs between multiple quality attributes.**

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Quality Attributes/Criteria 2

- Quality Attributes
  - The importance or **priority of each quality attribute differs** from system to system
    - In some cases, system performance, scalability, security, and usability will be more important than interoperability. Interoperability is likely to be more important in off-the-shelf software

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Quality Attributes/Criteria 2.1

- **System qualities**: overall qualities of the system when considered as a whole, e.g. supportability, testability.
- **Run-time qualities**: qualities of the system directly expressed at run-time - availability, interoperability, manageability, performance, reliability, scalability, and security.
- **Design qualities**: qualities reflecting the design of the system - conceptual integrity, flexibility, maintainability, and reusability.
- **User qualities**: usability of the system.

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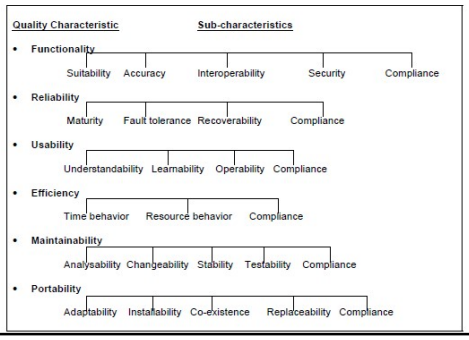
Quality Models: ISO 25010



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ISO 25010: Example

Quality Criteria Applied at Architecture Level 1

- **Functionality**
  - **Suitability**: provides the adequate functions for the required tasks.
    - Identification of system's functionalities.
    - Provision of an architecture specification with the **specified functionality decomposed into functions** associated to components which will meet the functional requirements of the system

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ISO 25010: Example

Quality Criteria Applied at Architecture Level 2

- **Functionality**
  - **Accuracy**: provides the right or agreed results or effects with the needed degree of precision.
    - Identification of the components with the functions responsible of the **computations** (functional components)

ISO 25010: Example

Quality Criteria Applied at Architecture Level 3

- **Functionality**
  - **Interoperability**: the ability to interact with one or more specified systems.
    - Identification of the connectors communicating with external specified systems. For example, to require Web services compatibility implies the existence of components.

ISO 25010: Example

Quality Criteria Applied at Architecture Level 3.1

- **Functionality**
  - **Interoperability**:
    - Determined by the presence or not of corresponding middleware components.(such as Web servers, application servers, content management systems) – e.g. Secure Sockets Layer (SSL) in the Sun Java System Application Server for authenticated and encrypted communication between clients and servers.

ISO 25010: Example

Quality Criteria Applied at Architecture Level 4

- **Functionality**
  - **Security**: the ability to prevent unauthorized access to programs or data.
    - Provision of a mechanism or device (software or hardware) to perform explicitly this task, may be a component (e.g., a service provided by the middleware) or a functionality integrated into a component

ISO 25010: Example

Quality Criteria Applied at Architecture Level 5

- **Reliability**
  - **Fault tolerance**: the ability to maintain a specified level of performance in case of software fault or of infringement of its specified interface.
    - Provision of a mechanism or software device, which may be a component or integrated into a component, e.g. **exception handling**

ISO 25010: Example

Quality Criteria Applied at Architecture Level 6

- **Reliability**
  - **Recoverability**: Capability to re-establish the level of performance and to recover the data and required time/effort.
    - Provision of a mechanism or software device, which may be a component or integrated into a component, to re-establish the level of performance or to recover the data, e.g. redundancy.

ISO 25010: Example

Quality Criteria Applied at Architecture Level 7

- **Portability**
  - **Installability**: the capability of the software product to be installed in a specified environment.
    - Provision of an install mechanism

More on ISO 25010 Quality Model: S. Wagner, Software Product Quality Control, DOI 10.1007/978-3-642-38571-1 2, © Springer-Verlag Berlin Heidelberg 2013

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ISO 25010: Case Study

Market Stock Exchange Monitoring System (MSEMS)

- **Requirements:** a real-time data provider, for monitoring stock exchanges for brokers and independent investors. An antenna (**feed server**), external to the system, provides the data (feed) to the **data server**. A feed contains the relevant information of a stock exchange transaction. **The clients** (brokers), distributed in different geographical locations, subscribe with the data server. When a change on the feed to which a client has subscribed occurs, the feed is broadcasted to the client by the data server, according to a strict time delay. The time delay will depend on the network structure. Requirements for the system are high security, availability, platforms heterogeneity, distribution of clients, reliable information with strict deadlines.

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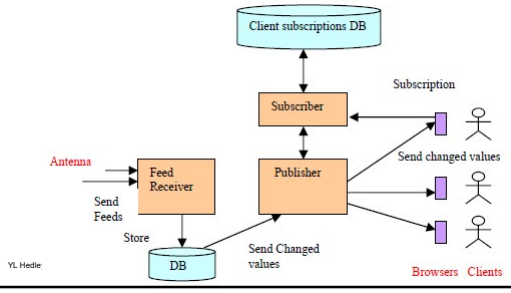
ISO 25010: Case Study

MSEMS Architecture Model 1: Publisher-Subscriber



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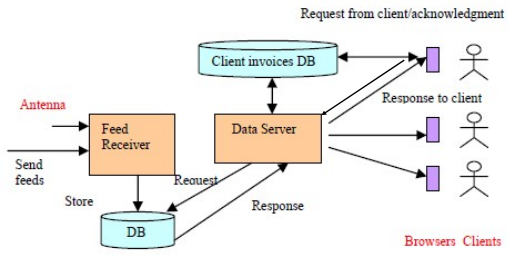
ISO 25010: Case Study

MSEMS Architecture Model 2: Repository



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Activity

- Evaluate the Publisher-Subscriber and Repository approach to the MSEMS system, which is better?
  - Security
  - Efficiency
    - in time behaviour (time spent from the data reception to the data delivery)
    - in resource utilization (usage of time)
  - Reliability

ISO 25010: Case Study

MSEMS Architecture Design 1

- Architecture designs in relation to quality characteristics
  - Model 1: **Publisher-Subscriber**, achieving better results in:
    - **Security**: a subscription mechanism , a better mechanism
    - **Efficiency in Time behaviour (time spent from the data reception to the data delivery):** better as less time required

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ISO 25010: Case Study

MSEMS Architecture Design 2

- Architecture designs in relation to quality characteristics
  - Model 2: **Repository** achieving better results in:
    - **Reliability (**maturity i.e. the capability of the software product to avoid failures**):** fewer components in the architecture
    - **Efficiency in resource utilization (time):** better as the Browser displays only on request

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Activity

- Evaluate the architecture solution based on the requirements for the MSEMS case study:
  - Publisher-Subscriber (Model 1) or Repository (Model 2) ?

ISO 25010: Case Study

MSEMS Architecture Design Comparison 3

- Overall architecture assessment for software quality:
  - Model 1 is better solution to Model 2 as given in the requirements of the MSEMS case study: **security and efficiency in time behaviour** should be considered to be the priority and are thus more important, than reliability (maturity) and efficiency in resource utilization (time)

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