

Interoperability: A Personal View

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Interoperability: Introductory concepts

Interoperability intended as the ability of two entities to work together very much depends on:

- The working context in which the two entities are embedded (web services, digital libraries, cultural heritage, control and command systems, etc.)
- The nature of the interoperable entities (people, software components, organizations, etc.)

Interoperability: introductory concepts (II)

Due to its inherent complexity and multifaceted nature, interoperability has been often misunderstood:

- Simple information/data exchangeability has been confused with interoperability
- Several forms of compatibility (composability, replaceability) have also been confused with interoperability
- when addressing interoperability between two entities the fact that often these belong to two different organizations which have their own policies has been ignored

Interoperability: Definition

“The ability of two or more systems to **exchange** information and to **use** the information that has been exchanged” (IEEE)

- (i) The two entities must be able to exchange **meaningful** information objects (**exchangeability**)
- (ii) The two entities must be able to exchange **logically consistent** information objects (when the exchanged information objects are descriptions of functionality, policy, or behavior (**compatibility**))
- (iii) The consumer entity must be able to **use** the exchanged information in order to perform a set of tasks that depend on the utilization of this information (**usability**)

Exchangeability

The **heterogeneity** Problem

Different sources of heterogeneity can be encountered depending on:

How the information objects are represented

How information objects are requested

The semantic meaning of each information object

The use of different terminologies

How information objects are actually transported over a network

Exchangeability (II)

Three types of heterogeneity to be overcome in order to achieve a meaningful exchange of information objects:

- Heterogeneity between data languages
(**syntactic exchangeability**)
- Heterogeneity between the models adopted for representing information objects
(**structural exchangeability**)
- Heterogeneity between the “semantic universe of discourse” of the producer and consumer entities
(**semantic exchangeability**)

Exchangeability (III)

The three levels of **exchangeability** i.e., **syntactic**, **structural**, and **semantic** allow a **meaningful** exchange of information objects between the two entities and thus guarantee the **exchangeability** between them.

Compatibility

The **Logical Inconsistent** Problem

Logical inconsistencies between:

- functional description of services (producer) and requests (consumer)
- policy descriptions
- behavioral descriptions

Compatibility

Usage

The Usage Inconsistent Problem

“The consumer’s goal cannot be achieved by using the producer’s resources”

Inconsistencies between the consumer goal and the producer resource description:

Quality mismatching

Data-incomplete mismatching

Usage (II)

Quality mismatching

The quality profile associated with the exported information object does not meet the quality expectations of the consumer entity

Data-incomplete mismatching

The exported information object is lacking some useful information to enable the consumer to fully exploit the received information object

Need for **descriptive information** (contextual, provenance, security, privacy, etc.)

Need for **purpose-oriented** descriptive data models (**metadata models**)

Mediation

The main concept enabling “meaningful” exchange of information objects is **mediation**

The mediation concept is implemented by a **mediator**, which is a software device capable of establishing exchangeability or compatibility of resources by resolving heterogeneities and inconsistencies

Mediation scenarios

mediation of data structures

mediation of functionalities

mediation of policies

mediation of protocols

Mediation (II)

The ultimate aim should be the definition and implementation of an “**integrated mediation framework**” capable of providing means to handle and resolve all kinds of heterogeneities and inconsistencies that may hamper the effective usage of the resources of an information infrastructure

Interoperability

End of the presentation!

Thank you