

Evaluating the Quality of Web 2.0 Applications

Agenda

- Characterizing Web 2.0 Apps
- Quality and Models
- Information Quality
- Measuring and Evaluating Quality
 - Example: Content Suitability
 - Metrics and Indicators
- Conclusions

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Characterizing Web 2.0 Apps

Murugesan in (Web Application Development: Challenges and the Role of Web Engineering. Chapter in Springer Book: *Web Engineering: Modeling and Implementing Web Applications*. Rossi, Pastor, Schwabe, & Olsina (Eds). 2007, pp. 7-32) **says**:

- *“Web 2.0 is gradually becoming recognized as an important collection of technologies, business strategies, and social trends.*
- *As a result of these developments the Web is changing fast from a static, one-way publishing medium to a highly interactive, dynamic application platform for fielding new kinds of applications.*
- *Besides leveraging the users’ potential in generating content, these applications provide facilities to keep the content under the user’s own categories (tagging feature) ... access it easily (Web feed tool)... and integrate multiple services under a rich user interface”*



Characterizing Web 2.0 Apps

- Early WebApps can be grouped in the **Web 1.0 era**
 - Static and Dynamic;
- Most recent ones, can be grouped in the **Web 2.0 era**
as per O'Reilly
 - These allow people collaborate, share and edit online information under new ways of interaction.
- Other applications,
 - which could be referred as the **Mobile Web era**, offer additional features such as personalization and context-aware capabilities and services;
 - the **Semantic Web era** –also named Web 3.0, where applications offer the automatic processing of information meaningfully.



Characterizing Web 2.0 Apps

In the Web 2.0 era , apps can be characterized as:

- **User generated content:**

- Checking the rating of the most popular sites, currently, after 'google.com' and 'yahoo.com', one of the most visited is 'youtube.com'.
- Maybe the best example to explain how big has become the Web 2.0 phenomenon and what user generated content means.

- **User active involvement:**

- the active participation of users is one of the most important features.
- Now users' role can be defined as '*prosumer*' since s/he is content producer and consumer at the same time.
- WebApps like blogs are significant examples.



Characterizing Web 2.0 Apps

In the Web 2.0 era , apps can be characterized as:

- **Sharing information:**

- Let's think about social network services, where people share interests and activities.
- Examples of these applications are 'myspace.com', 'facebook.com', etc.

- **Endless beta condition:**

- Web 2.0 apps are mostly dynamic and under ongoing changes.
- Wikipedia is for instance continually subject to editing by users so there is no a 'final version' of it.





Travel Social Network: Where Are You Now?

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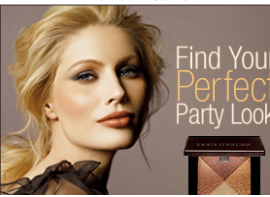
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Characterizing WebApps

WebApps (1.0, 2.0 ...) have their own features distinct from traditional software apps:

- WebApps will be even more **information-driven, content-oriented**.
 - Most WebApps, besides the increasing support to functionalities and services –seen since the dynamic Web 1.0 era- will continue aiming at showing and delivering multimedia information.
 - This info orientation is a basic feature stemming from the early, static Web 1.0 era.
- WebApps are interactive, user-centered applications, where the user interface plays a central role; thus, they will continue to be highly focused on the look and feel.
 - Web interfaces ought to be easy to use, understand, operate, and navigate because thousands of users with different profiles and capabilities interact with them daily;
 - Currently they have to cope with a variety of display devices and screen sizes.
- The Web embodies a greater bond between art and science than that encountered in software applications.
 - Aesthetic features of WebApps demand not only technical skills but also graphical design or artistic skills.



Characterizing WebApps

WebApps (1.0, 2.0 ...) have their own features distinct from traditional software apps:

- **Internationalization** and **accessibility** of contents for users with various disabilities are real and challenging issues in WebApps,
 - Independently of eras.
- Searching and browsing are two basic functionalities used to find and explore information and services.
- **Security** is a central issue in data- transaction-oriented WebApps.
 - Likewise, performance is also critical for many WebApps, although both are also critical features for traditional applications.
- The medium where WebApps are hosted and delivered is generally more unpredictable than the medium where traditional software applications run.
 - For instance, unpredictability in bandwidth maintenance, or in server availability, can affect the users' perceived quality



Characterizing WebApps

WebApps (1.0, 2.0 ...) have their own features distinct from traditional software apps:

- **Contents privacy** and intellectual property rights of materials are current issues too. They involve ethic, cultural, and legal aspects as well.

To Remark

- Most of the above features make a WebApp a particular artifact.
 - However, like any software application, it also involves source and executable code, persistent structured data, architectural design, and so on.
- Ultimately, many of the above features will influence the way quality requirements are modeled.
- We need to deal not only with usability, functionality, efficiency, reliability and maintainability, as in traditional software products but also with **info quality**, i.e. with **content accuracy**, **suitability**, **accessibility**, and **legal compliance**



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ISO Stds. about Quality, Measurement

- Many ISO Standards deal with quality, evaluation, e.g.:
 - **Quality (Sw Product):** internal and external quality models, and quality-in-use model for sw. (ISO 9126-1:2001)
 - **Quality (Process):** process assessment and capability determination for software organizations (ISO 15504:2003)
 - **Evaluation:** The evaluation process (ISO 14598:1998)
 - **Measurement:** The measurement process (ISO 15939:2002)

We often have observed a lack of consensus in the terminology in those documents

same terms different meaning, different terms with similar meaning, absent terms, etc.

We will use some terms regarding quality, quality measurement, and quality evaluation coming from our ontology [Olsina et al 2003/04]



What is Quality?

Quality

- **Quality** of an entity is hard to define and assess but it is easy to recognize
- Generally, the **perceived quality** of an entity is transparent when present, but noticeable when absent



What is Quality?

Quality usually has different views (as per Garvin, 87):

- Transcendent View
- User View
- Product View
- Producer View
- Value-based View
 - quality/cost trade-off



What is Quality?

- The **quality concept** is not simple and atomic, but a multi-dimensional and abstract concept.
- Quality can not be measured and evaluated directly,
 - at least in a not very trivial way
- Common practice assesses quality by means of the quantification of lower abstraction concepts, such as attributes of entities
- Given the inner complexity that a quality concept involves, it is necessary generally a **model** in order to specify the quality requirements.

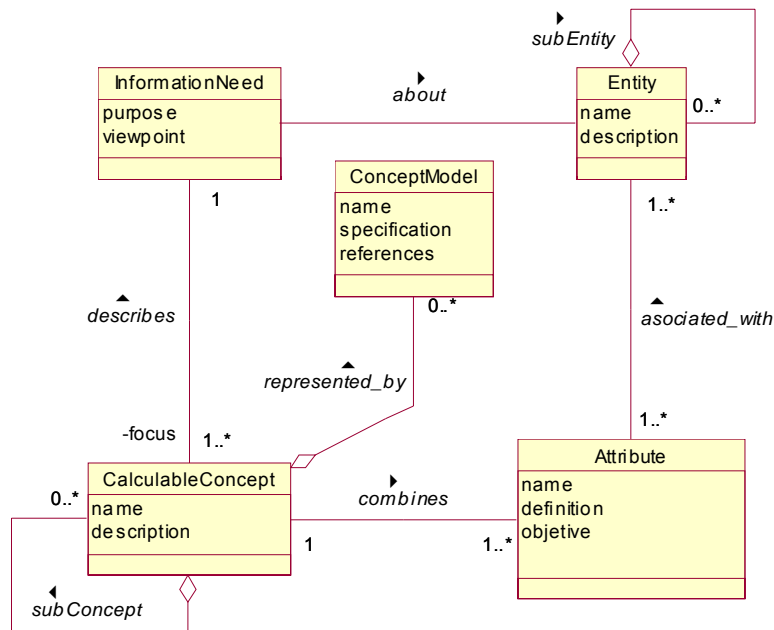


What is Quality?

- Quality depends on a specific project/organizational **information need**, i.e., for a specific **purpose**, **user viewpoint**, and **context**
- Quality is an **abstract relationship** between **attributes** of an **entity** (a product, process, ...) and a specific **information need** for a project, or organization.



To Represent Quality ...



Quality vs. Project Variables

- Scope
 - . Functionalities / Services / Contents to deliver
- Time (Schedule)
 - . Effort (person per hour)
 - . Calendar (working and not-working days)
 - Time-to-Market
- Quality
 - . Product
 - Product in Use
 - . Process
 - Capability
 - . Resource
 - Human Skills,
 - Methods, Tools, ...
- Cost
 - . Budget



Non-quality Costs and Impact

- Waste of:
 - effort (person-hour)
 - materials
- Loss of time
 - to be the product available
- Re-work
 - For repairing / fixing defects
 - Impact of changes
- Impact wrt the customer
 - loss of the enterprise image
 - loss in the product trustfulness
 - likely lower sales



Define Quality is a hard job ...

Define, Specify the Quality depends on the:

- Entity to be applied
 - Project (Development, Maintenance, ...)
 - Process
 - Product
 - Resource
 - Service
- Perspective (User Viewpoint/Profile)
 - Developer, Manager, Final User, ...
 - Often, for the same user profile (to different –or similar, projects) there are different needs, priorities ...
- Domain
- Lifecycle Stages
 - Early, Late, Operative ...



What is Quality?

Quality is not an absolute concept but rather a relative, multi-dimensional and contextual one

Quality of a Sw Product (as per ISO/IEC 9126-1: 2001)

- The totality of characteristics of an entity that bears on its ability to satisfy stated or implied needs
- The extent to which a product satisfies stated and implied needs when used under specified conditions
- **Characteristics**
 - Usability, Functionality, Efficiency, Reliability ...



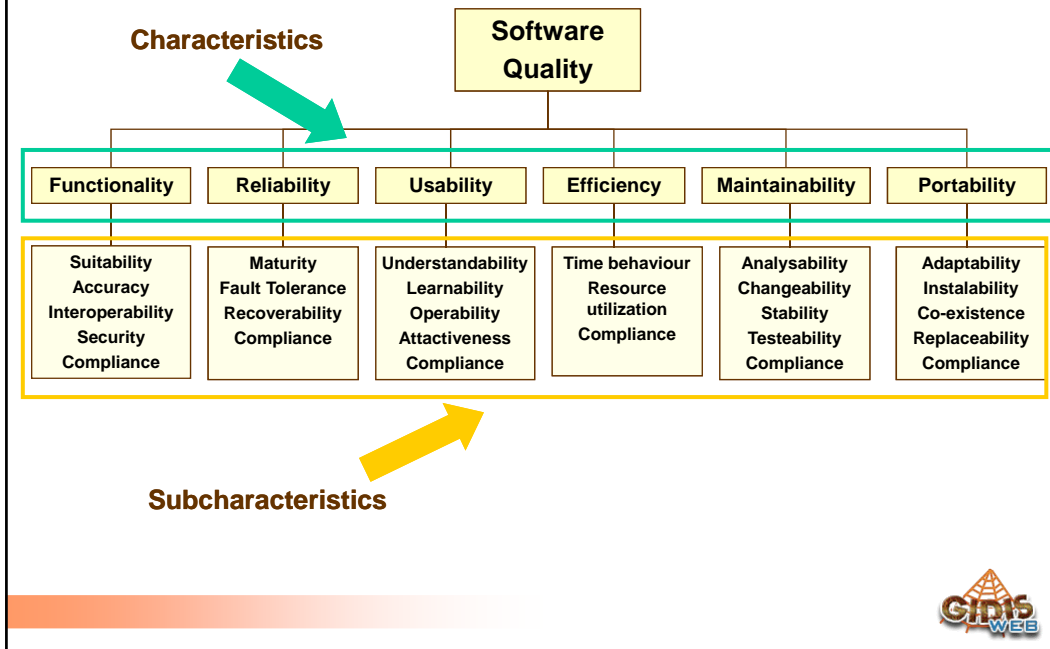
What is Quality Model?

Quality Model

- The set of characteristics and the relationships between them which provide the basis for specifying quality requirements and evaluating quality (as per ISO/IEC 9126-1)



The ISO 9126-1 Quality Model



What is Quality?

Quality of a Software Product (ISO/IEC 9126-1: 2001)

Three Views for Quality:

- **Internal Quality – Def.**
 - The totality of attributes of a product that determines its ability to satisfy stated and implied needs when used under specified conditions
- **External Quality – Def.**
 - The extent to which a product satisfies stated and implied needs when used under specified conditions
- **Quality in Use – Def.**
 - The capability of software product to enable specified users to achieve specified goals with effectiveness, productivity, safety and satisfaction in specified context of use.

Perspectives of Quality: ISO 9126-1

- **Internal Quality** is specified by a quality model (the six characteristics shown)
- It can be measured and evaluated by static attributes of documents such as specification of requirements, architecture, or design; pieces of source code, and so forth.
- In early phases of a software or Web lifecycle, we can evaluate and control the internal quality of these early products.
- But assuring internal quality is not usually sufficient to assure external quality.



Perspectives of Quality: ISO 9126-1

- **External Quality** is specified by a quality model (the six characteristics shown)
- It can be measured and evaluated by dynamic properties of the running code in a computer system, i.e. when the module or full application is executed in a computer or network simulating as close as possible the actual environment.
- In late phases of a software lifecycle (e.g. in different kinds of testing, or even in the operational state of a software or Webapp), we can measure, evaluate and control the external quality of these late products,
- But assuring **external quality** is not usually sufficient to assure **quality in use**.



Perspectives of Quality: ISO 9126-1

- **Quality in Use** is specified by a quality model (four characteristics),
- It can be measured and evaluated by the extent to which the software or Web application meets specific user's needs in the actual, real, specific context of use.
- Regarding the spirit of this standard, quality in use is the end user's view of the quality of a running system containing software, and is measured and evaluated in terms of the result of using the software, rather than by properties of the software itself.



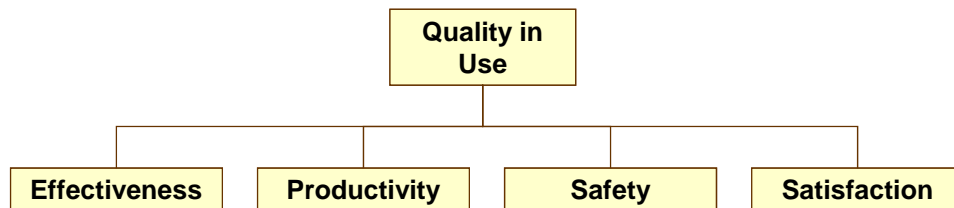
Perspectives of Quality: ISO 9126-1

- Attributes of internal and external quality of a software product are rather **the cause**, attributes of quality in use rather **the effect**.
- QinU evaluates the degree of excellence, and can be used to validate the extent to which the software or Web meets specific user needs.
- Considering appropriate attributes of the software (or Web) for internal quality is a prerequisite to achieve the required external behavior, and considering appropriate attributes of the software to external behavior is a prerequisite to achieve quality in use



Quality-in-use Model

- **Quality in use** is the final user's view of quality
 - similar to the definition of Usability in ISO 9241-11
- *The capability of software product to enable specified users to achieve specified goals with effectiveness, productivity, safety and satisfaction in specified context of use. ISO/IEC 9126-1:2001.*



Quality in Use Characteristics

- **Effectiveness**

The capability of software product to enable users to achieve specified goals with accuracy and completeness in a specified context of use.

- **Productivity**

The capability of software product to enable users to expend appropriate amounts of resources in relation to the effectiveness achieved in a specified context of use.

- **Satisfaction**

The capability of software product to satisfy users in a specified context of use.

- Satisfaction is the user's response to the interaction with the product (e.g. a WebApp), and include attitudes towards use of the product.



Quality in Use Model

Instance of QinU MODEL with associated Attributes

1. Quality in Use

1.1 Effectiveness

1.1.1 Task Effectiveness (TE)

1.1.2 Task Completeness (TC)

1.2 Productivity

1.2.1 Efficiency related to Task Effectiveness (ETE)

1.2.2 Efficiency related to Task Completeness (ETC)

1.3 Satisfaction



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Data vs. Information

Some slight difference in meaning between data and information concepts.

- A piece of **data** is raw material; even though it could bear some degree of information.
- Data come from attribute measurements, facts, formula calculations, etc.
 - basically they have categorical or numerical values, a scale type, and may also have an explicit procedure to produce or collect them.
- Structured data sets are often represented in databases.
- On the other hand, **information** has an added value over data.
 - That is, information is the meaningful interpretation of data for a given **context**, purpose, and user viewpoint.



Data vs. Information

- Usually, a traditional software program is a mixture of functions and data.
- Many web pages are content oriented, i.e. are intended to deliver information (usually unstructured semantically).
- For example, a scientific article can be hyperlinked and posted as content Web pages.
- A webpage component, e.g. a shopping cart, can edit an item quantity and recalculate prices (applying a function over data). However, also may show contextual information ...



Shopping Cart: Data/Information/Functions

cuspid.com Argentina, Miércoles 1 de Abril de 2009

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What is Web Quality?

As aforementioned, information has added value over data, and hereafter we consider Web information as Web content, which can be textual or other media.

- We argue the three ISO views (and quality models) are also applicable to a great extent to intermediate and final life-cycle Web 1.0 and 2.0 applications
- Like any software line production, the Web lifecycle involves different stages of its products whether in early phases as inception and development, or late phases as deployment, operation and evolution.

What is Web Quality?

- Thus, to the **general question** if we can apply the same ISO internal and external quality, and quality in use models, the natural answer is *yes*
- However, to the **more specific question** whether we can use the same six-prescribed quality characteristics for internal and external quality, and the four characteristics for quality in use, our answer is *yes* for the latter, but some other considerations might be taken into account for the former.



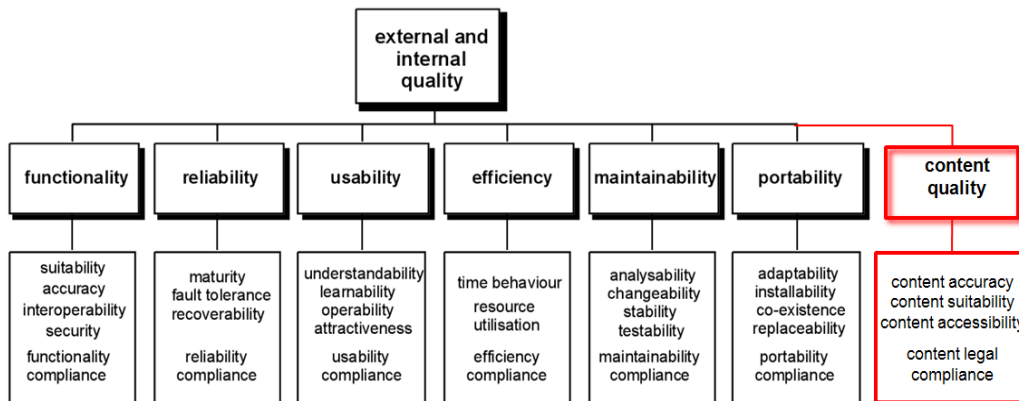
What is Web Quality?

- The very nature of WebApps is a mixture of data/information, functionalities and services.
- We argue that the six quality characteristics (i.e., *Usability*, *Functionality*, *Reliability*, *Efficiency*, *Portability*, and *Maintainability*) are not well suited (or they were not intended) to specify requirements for information quality.
- A **new Characteristic** related with **information quality** is needed, mainly for the Internal and External quality models



Proposed Extension to the ISO 9126-1 Models

Content quality (Infoquality): the capability of a Web product to deliver information which meets stated and implied needs when used under specified conditions

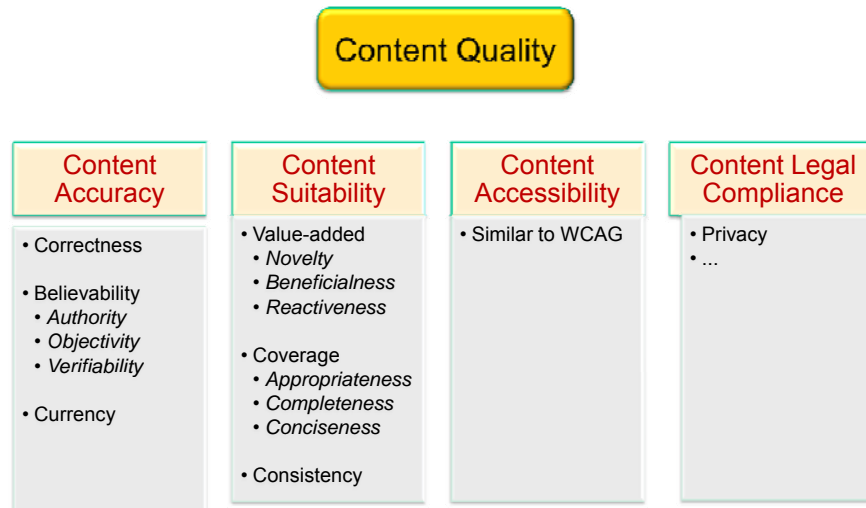


Content Quality Sub-characteristics

| Sub-characteristic | Definition |
|---------------------------------|--|
| Content Accuracy | The capability of a WebApp to deliver information that is correct, credible and current. |
| Content Suitability | The capability of a WebApp to deliver information with the right coverage, added value, and consistency, considering the specified user tasks and goals. |
| Content Accessibility | The capability of a WebApp to deliver information that is accessible for all users (with or without disabilities) taking into account both technical and representational aspects. |
| Content Legal Compliance | The capability of a WebApp to adhere to standards, conventions, and legal norms related to content as well as to intellectual property rights. |



Content Quality Sub-characteristics/Attributes



Content Accuracy Sub-characteristics/Attributes

Accuracy The capability of a WebApp to deliver information that is correct, credible and current.

Correctness, the extent to which information is reliable in the sense of being free of errors.

Believability (synonym: Credibility), the extent to which the information is reputable, objective, and verifiable.

Authority (synonym: Reputability), the extent to which the source of the information is trustworthy.

Objectivity, the extent to which the content (i.e., information or facts) is unbiased and impartial.

Verifiability (synonym: Traceability), the extent to which the owner and/or author of the content can be verified

Currency (synonym: Up-to-dateness), the extent to which the information can be identified as updated.



Content Suitability Sub-characteristics/Attributes

Suitability The capability of a WebApp to deliver information with the right coverage, added value, and consistency, considering the specified user tasks and goals.

Value-added, the extent to which the content can be novel, beneficial, and contribute to react to a given user for the task at hand.

Novelty (synonym: Freshness), the extent to which the information is fresh and contributes to make new decisions for an intended user goal.

Beneficialness, the extent to which the information is advantageous and contributes to make new decisions for an intended user goal.

Reactiveness, the extent to which the information is compelling and contributes to react for an intended user goal.



Content Suitability Sub-characteristics/Attributes

Suitability The capability of a WebApp to deliver information with the right coverage, added value, and consistency, considering the specified user tasks and goals.

Coverage, the extent to which the content is appropriate, complete but also concise for the task at hand to a given user.

Appropriateness, the extent to which the information coverage fits to an intended user goal.

Completeness, the extent to which the information coverage is the sufficient amount of information to an intended user goal.

Conciseness, the extent to which the information coverage is compactly represented without being overwhelming.

Consistency, the extent to which the content is consistent to the site's piece of information or webpage with respect to the intended user goal.



Other Considerations

- In addition to the above content quality sub-characteristics, others to information architecture and organization could be addressed.
- Many of these sub-characteristics, such as global understandability, learnability, and also operability and attractiveness, can be related to the **usability** characteristic.
- Besides, other particular non-functional requirements for search and navigation functions and services can be specified in the **functionality** sub-characteristics;
 - for example, are the basic and advanced search suitable for the end user?
 - Or, are they tolerant of misspelled words and accurate in retrieving documents?



Other Considerations

- In the same way, we can represent link and page maturity attributes, or attributes to deficiencies due to browsers' compatibility into the **reliability** sub-characteristics.
- Finally, from the **quality in use** perspective, we have proposed to use the same ISO model. However, for the satisfaction characteristic, specific (questionnaire) items for evaluating quality of content should be included.



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Content Suitability. Some Sub-characteristics/Attributes

| External Quality Requirements (for Shopping Cart Entity) | |
|--|--|
| 1 | Usability |
| 1.1 | Understandability |
| 1.1.1 | Icon/label ease to be recognized |
| 1.1.2 | Information grouping cohesiveness |
| 1.2 | Learnability |
| 1.2.1 | |
| 1.3 | Operability |
| 1.3.1 | Control permanence |
| 1.3.2 | Expected behaviour of the Ccontrols |
| 2 | Content Quality (Infoquality) |
| 2.1 | Content suitability |
| 2.1.1 | Basic information coverage |
| 2.1.1.1 | Line item information completeness |
| 2.1.1.2 | Product description appropriateness |
| 2.1.2 | Coverage of other contextual Information |
| 2.1.2.1 | |



Example: Content Suitability. Cúspide.com catalog

cuspid.com

Argentina, Sábado 21 de Marzo de 2009

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| 7 | MAS ANA | AGENTES SOFTWARE Y SISTEMAS MULTI-AGENTE | \$ 96,00 | 48 Hs. |



Example: Content Suitability. Shopping Cart (Before)

The screenshot shows the shopping cart page of cuspid.com. The page has a header with the site logo and navigation links. The main content area is titled 'Información actual del pedido'. It contains a table of items in the cart, a subtotal, and a button to proceed to checkout. Annotations highlight specific features:

- 1.1.1 Shopping cart icon / label ease to be recognized:** Points to the shopping cart icon in the top right navigation bar.
- 1.3.2 Expected behaviour of the delete control:** Points to the 'Borrar' (Delete) checkbox in the first column of the item table.
- 2.1.1.1 Line item information completeness:** Points to the first row of the item table, which includes the item name, quantity, and price.
- 2.1.1.2 Product description appropriateness:** Points to the detailed description of the first item, 'INGENIERIA DE SOFTWARE', which includes a note about delivery time.

| Borrar | Título | Cantidad | Precio |
|--------------------------------|--|----------|---------------------|
| <input type="checkbox"/> | INGENIERIA DE SOFTWARE Normalmente salida del depósito en 2 días | 1 | \$ 59,00 |
| <input type="checkbox"/> | INGENIERIA DEL SOFTWARE En Stock. Salida del depósito en 24 horas | 1 | \$ 100,00 |
| <input type="checkbox"/> | INGENIERIA DEL SOFTWARE En Stock. Salida del depósito en 24 horas | 1 | \$ 95,00 |
| El peso de su orden es 2,42 Kg | | | Subtotal: \$ 254,00 |

Las órdenes enviadas dentro o fuera de Argentina se facturan en Pesos. Para obtener un valor estimado en Dólares, la cotización actual es de 3,10 Peso Argentino = US\$ 1.00 Dolar

Presione este botón para informar la dirección de envío y medio de pago.

Example: Content Suitability. Recalling...

Content Suitability

The capability of a WebApp to deliver information with the right coverage, added value, and consistency, considering the specified user tasks and goals.

Coverage, the extent to which the content is appropriate, complete but also concise for the task at hand to a given user.

Appropriateness, the extent to which the information coverage fits to an intended user goal.

Completeness, the extent to which the information coverage is the sufficient amount of data/information to an intended user goal.

Conciseness, the extent to which the information coverage is compactly represented without being overwhelming.

Consistency, the extent to which the content is consistent to the site's piece of information or page with respect to the intended user goal.

Example: Content Suitability. Shopping Cart (After)

cuspid.com Argentina, Miércoles 4 de Julio de 2007

Catálogos Búsquedas Novedades Servicios

SELECCIONE

Búsquedas

Por ISBN
Por Temas
Por Autor y Título
Búsquedas Avanzadas

Links

Locales de Venta
En Argentina
Libros a Pedido
Consulte
Eventos
Ferias, Presentaciones
Información
Cómo contactarse
Links a Editoriales
Interés General y Científicas

Información actual del pedido

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Información acerca de Gastos de Envío y Tiempo de Entrega

GIDIS WEB

Agenda

- Characterizing Web 2.0 Apps
- Quality and Quality Models
- Information Quality
- **Measuring and Evaluating Quality**
 - Example: Content Suitability for a Shopping Cart
 - Attributes, Metrics and Indicators
- Conclusions

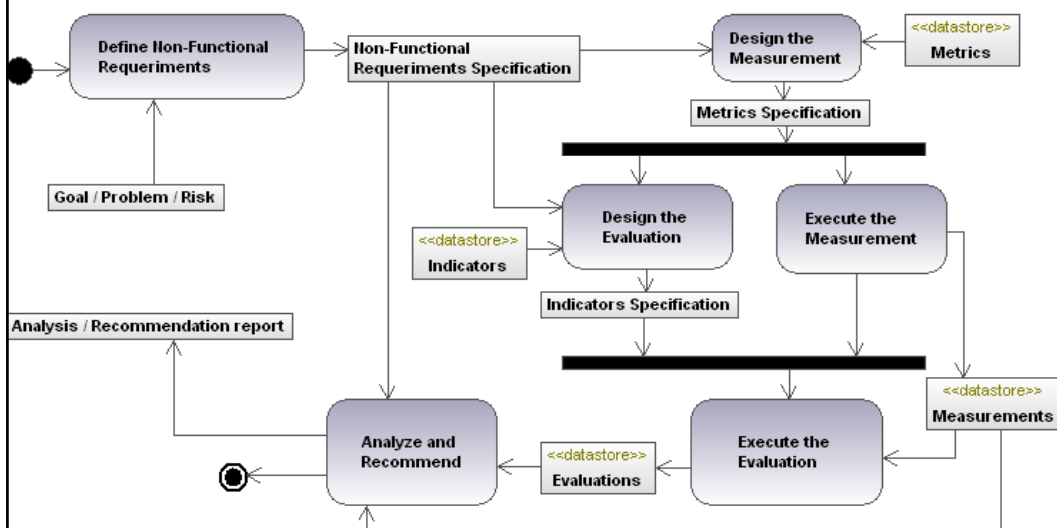
Our Measurement/Evaluation Approach

Our approach is based on three tenets:

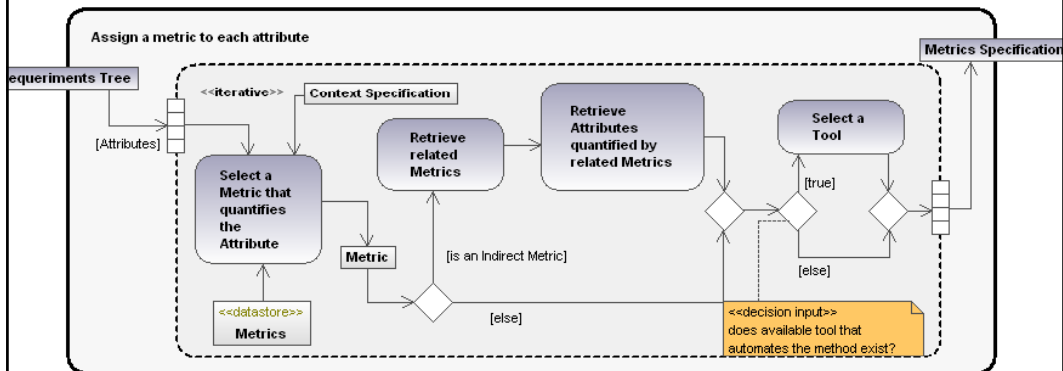
- A **process for measurement and evaluation**, i.e. the main managerial and technical activities that might be planned and performed.
- A **measurement and evaluation framework** that must rely on a sound conceptual (ontological) base.
- Specific model-based **methods and techniques** in order to carry out specific activities.



Measurement & Evaluation Process (Becker , Molina & Olsina)



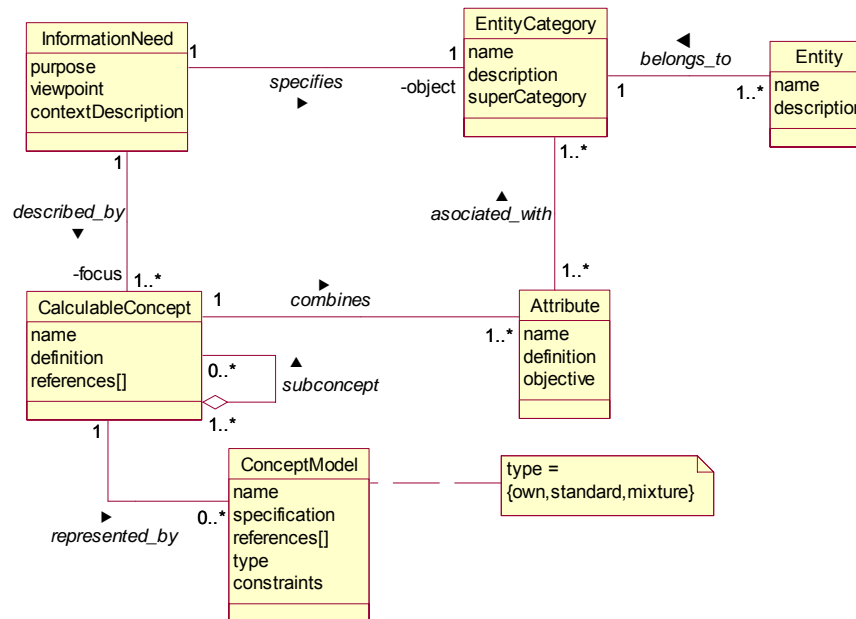
Measurement & Evaluation Process(to design Measurement)



Concepts for NFR

- Information Need
- Entity Category/Entity
- Attribute
- Quality, Quality in Use
 - CALCULABLE CONCEPT
- External Quality Model, Quality in Use Model
 - CONCEPT MODEL

Model for NFR



Concepts for NFR

• INFORMATION NEED

- Insight necessary to manage objectives, goals, risks, and problems.
 - External Quality,
 - Quality in Use, etc.
- To our example, “Understand (and further improve) the External Quality (w.r.t. its Usability and Content quality) to the Cuspide.com shopping cart
 - Purpose = Understand / Improve
 - User Viewpoint = final users
 - Calculable Concept = External Quality
 - Entity Category = e-bookstore WebApp (Product)
 - Entity = Cuspide.com shopping cart



Concepts for NFR

- **ENTITY CATEGORY**

- Object category that is to be characterized by measuring its attributes
- High Level Categories: Product, Process, Resource, Project,...

- **ENTITY** (syno. Object)

- A concrete object that belongs to an entity category.
- Example: given the *entity category* (i.e., an e-bookstore Web application, which its *superCategory* is a product) a concrete object that belongs to this category is the "Cuspide.com" WebApp.



Instance of External Quality Model with associated Attributes

| External Quality Requirements (for Shopping Cart Entity) | |
|--|--|
| 1 | Usability |
| 1.1 | Understandability |
| 1.1.1 | Icon/label ease to be recognized |
| 1.1.2 | Information grouping cohesiveness |
| 1.2 | Learnability |
| 1.2.1 | |
| 1.3 | Operability |
| 1.3.1 | Control permanence |
| 1.3.2 | Expected behaviour of Controls |
| 2 | Content Quality |
| 2.1 | Content Suitability |
| 2.1.1 | Basic Information Coverage |
| 2.1.1.1 | Line item information completeness |
| 2.1.1.2 | Product description appropriateness |
| 2.1.2 | Coverage of other Contextual Information |
| 2.1.2.1 | |

Calculable Concept

Sub-Concept

Attribute



Concepts for NFR

ATTRIBUTE (syno. Property, Feature)

- A measurable physical or abstract property of an entity category.
- Note that the selected attributes are those relevant properties for the defined information need.
- To our example, an attribute *name* is
 - "Line item information completeness",
 - defined as
 - "the extent to which the line item information coverage is the sufficient amount of data to an intended user goal"
- An attribute can be quantified (measured) by one or more direct or indirect metrics.



Concepts for NFR

CALCULABLE CONCEPT (syno. Measurable Concept)

- Abstract relationship between attributes of entities categories and information needs.
- To our example, the *calculable concept* is "External quality" and two *sub-concepts* are "Usability", and "Content quality".
- External Quality,
 - Content Suitability
 - Coverage
 - Completeness...
- For instance, the "Completeness" sub-concept is defined as "the extent to which the information coverage is the sufficient amount of information to an intended user goal".
- The calculable concept can be *represented by a concept model*.



Concepts for NFR

CONCEPT MODEL

- The set of sub-concepts and the relationships between them, which provide the basis for specifying the concept requirement and its further evaluation or estimation.
- the concept model *type* can be either
 - a standard-based model (ISO, etc.)
 - an organization own-defined model, or
 - a mixture of both.
- The concept model used in the example is of “mixture” *type* that is based on the ISO quality-in-use model, and its extension
 - note the model shows also *attributes* combined to the *sub-concepts*.



Instance of External Quality Model with associated Attributes

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Calculable Concept

Sub-Concept

Attribute

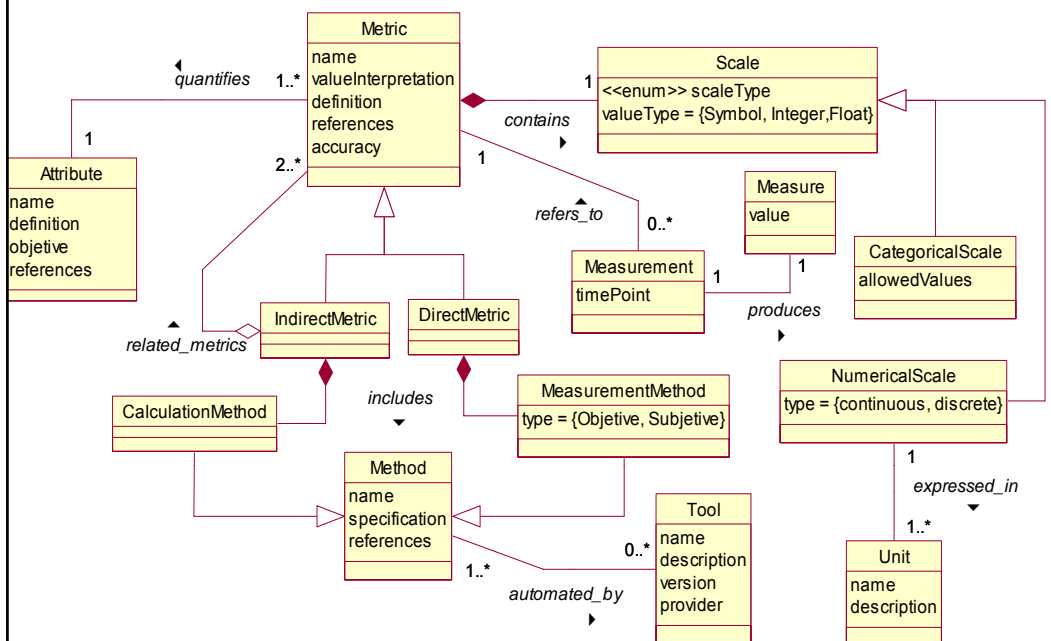


Concepts for Metrics/Measurement

- **Attribute**
- **Measurement**
- **Measure**
- **Metric**
 - Direct
 - Indirect (Formula)
- **Scale**
 - Scale Type
 - Categorical, Numerical (Unit)
- **Method**
 - Of Measurement/Calculation (Sw Instrument)



Model for Metric/Measurement



Concepts for Metric/Measurement

MEASUREMENT

- Activity that uses a metric definition in order to produce a measure's value.

MEASURE

- the number or category assigned to an attribute of an entity by making a measurement
- A *measurement* activity must be performed for each metric that intervenes in the project.
- It allows recording the *date/time stamp*, the *collector information* in charge of the measurement activity, and for the *measure*, the “actual” or “estimated” value *type* and the yielded *value* itself.



Concepts for Metric/Measurement

METRIC

- The defined measurement or calculation **method** and the measurement **scale**
 - Ex. *Total Number of Unique Titles*
- **DIRECT METRIC** (syno. Single, Base Metric)
- a metric of an attribute that does not depend upon a metric of any other attribute.
 - Ex. *Degree of completeness to the line item information*
- **INDIRECT METRIC** (syno. Hybrid, Derived Metric)
- a metric of an attribute that is derived from metrics of one or more other attributes.
 - Ex. *Degree of Unique Titles* (DUT = #UT / #TT)



Concepts for Metric/Measurement

MEASUREMENT METHOD (syno. Counting Rule, Protocol)

- the particular logical sequence of operations and possible heuristics specified for allowing the realisation of a metric description by a measurement.
- The **type of a measurement method** can be either
 - *subjective* i.e. where the quantification involves human judgement, or
 - *objective* i.e. where the quantification is based on numerical rules.
- Usually an objective measurement method type can be automated or semi-automated by a software tool.



Concepts for Metric/Measurement

SCALE

- a set of values with defined properties

Scale Type

- The type of scales depends on the nature of the relationship between values of the scale.
- The types of scales are commonly classified into *nominal*, *ordinal*, *interval*, *ratio*, and *absolute*.
- The scale type of measured values affect
 - the sort of arithmetical and statistical operations that can be applied to values (e.g. we can't add numbers in an ordinal scale)
 - the admissible transformations (e.g. $M' = a M$ for a ratio scale)



Concepts for Metric/Measurement

Categorical Scale

- a scale where the measured or calculated values are categories, and cannot be expressed in units, in a strict sense.

Numerical Scale

- a scale where the measured or calculated values are numbers that can be expressed in units, in a strict sense.

UNIT (for Numerical Scales)

- Particular quantity defined and adopted by convention, with which other quantities of the same kind are compared in order to express their magnitude relative to that quantity
 - Examples of Unit: LOC, bytes, words, links, tasks ...



Concepts for Metric/Measurement

Terms: Scale, Scale Type

| Scale type | Is ranking meaningful ? | Are distances between scales the same? | Does the scale include an absolute zero? |
|------------|-------------------------|--|--|
| Nominal | No | No | No |
| Ordinal | Yes | No | No |
| Interval | Yes | Yes | No |
| Ratio | Yes | Yes | Yes |
| Absolute | Yes | Yes | Yes |



Concepts for Metric/Measurement

Terms: Scale, Scale Type

| Scale type | Examples of suitable statistics | Suitable statistical tests |
|-----------------|--|-------------------------------|
| Nominal | Mode Frequency | Non-parametric |
| Ordinal | Median Percentile | Non-parametric |
| Interval | Mean Standard deviation | Non-parametric and parametric |
| Ratio | Mean Geometric mean Standard deviation | Non-parametric and parametric |
| Absolute | Mean Geometric mean Standard deviation | Non-parametric and parametric |



Instance of External Quality Model with associated Attributes

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| 2 | Content Quality |
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| 2.1.1 | Basic Information Coverage |
| 2.1.1.1 | Line item information completeness |
| 2.1.1.2 | Product description appropriateness |
| 2.1.2 | Coverage of other Contextual Information |
| 2.1.2.1 | |

Attribute



Example for Scale/Scale type

Direct metric: *Degree of completeness to the line item information*

The **scale** specifies three categories considering an **ordinal scale type**:

1. *Incomplete*; less info than category 2
2. *Partially complete*, i.e. it only has title, price, quantity, and sometimes availability fields;
3. *Totally complete*, i.e. it has title, author, price, quantity, added on date, and availability.

The specification of the **measurement method** is **objective** and the data collection can be made observationally or maybe automated by a **tool**.



Example: Content Suitability. Shopping Cart (Before)

Argentina, Miércoles 4 de Julio de 2007

cuspid.com

Catálogos Búsquedas Novedades Servicios

Información actual del pedido

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| | El peso de su orden es 2,42 Kg | Subtotal | \$ 254,00 |

2.1.1.1 Line item information completeness

Información acerca de Gastos de Envío y Tiempo de Entrega

Ir a la caja Presione este botón para informar la dirección de envío y medio de pago.

GIDIS WEB

Measures

| External Quality Requirements | Measure |
|---|----------|
| Global Quality Indicator | |
| 1 Usability | |
| 1.1 Understandability | |
| 1.1.1 <i>Icon/label ease to be recognized</i> | |
| 1.1.2 <i>Information grouping cohesiveness</i> | |
| 1.2 Learnability | |
| 1.2.1 | |
| 1.3 Operability | |
| 1.3.1 <i>Control permanence</i> | |
| 1.3.2 <i>Expected behaviour</i> | |
| 2 Content Quality | |
| 2.1 Content Suitability | |
| 2.1.1 Basic Information Coverage | |
| 2.1.1.1 <i>Line item information completeness</i> | 2 |
| 2.1.1.2 <i>Product description appropriateness</i> | |
| 2.1.2 Coverage of other Contextual Information | |
| 2.1.2.1 | |
| 2.1.2.2 <i>Return policy information completeness</i> | |



To Remark

Metrics are welcome when they are clearly needed and easy to collect and understand Pfleeger

- A Metric specifies in the numerical/symbolic world a specific mapping of an entity's attribute of the empirical world
- A Metric (in a measurement process) **can not interpret** itself a calculable concept

Need of INDICATORS (in an evaluation process) in order to get contextual information

Indicators are ultimately the foundation for interpretation of information needs and decision-making.

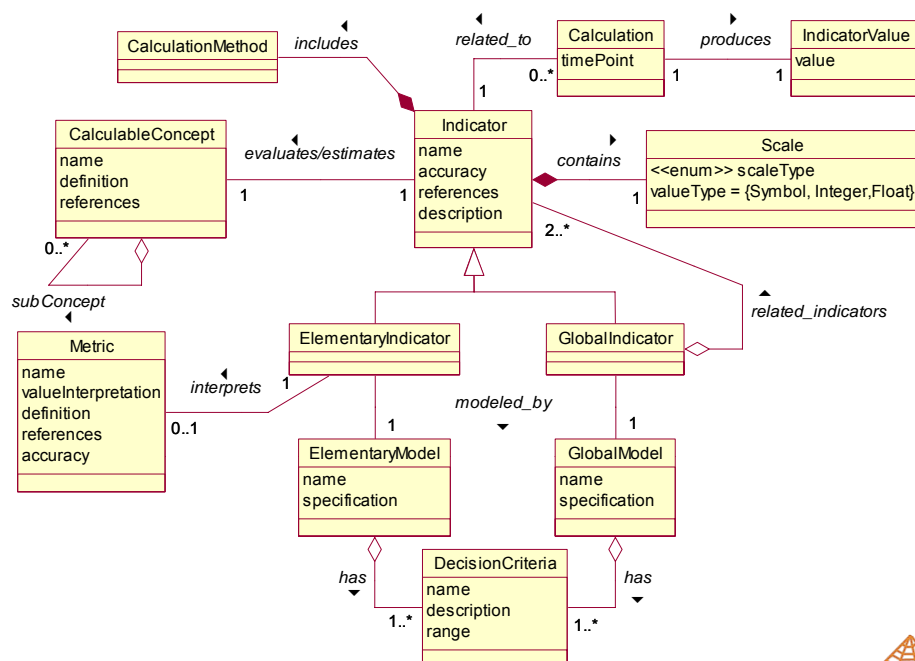


Concepts for Indicator/Evaluation

- Information Need
- Concept Model
 - Calculable Concept / Attribute
- INDICATOR
 - Elementary (interprets Metric's measure)
 - Global (calculates Concept Model)
- ELEMENTARY and GLOBAL MODEL
- DECISION CRITERIA (Acceptability Levels)
- EVALUATION, INDICADOR VALUE



Model for Indicator/Evaluation



Concepts for Indicator/Evaluation

INDICATOR (syno Criterion)

- the defined calculation **method** and **scale** in addition to the **model** and **decision criteria** in order to provide an estimate or evaluation of a calculable concept with respect to defined **information needs**.
- **Elementary Indicator** (syno. Elementary Criterion)
 - **Name:** *Satisfaction Level of the line item information completeness*
- **Global Indicator** (syno. Global Criterion)
 - **Name:** *Satisfaction Level of External Quality*



Concepts for Indicator/Evaluation

ELEMENTARY MODEL

- algorithm or function with associated decision criteria that model an elementary indicator.

Metric

Degree of completeness to the line item information

$$X = \{1, 2, 3\}$$

- **Elementary Indicator Model**

Satisfaction Level of the line item information completeness

$$EI = \{\{1, 0\}, \{2, 50\}, \{3, 100\}\}$$



Concepts for Indicator/Evaluation

DECISION CRITERIA

- Thresholds, targets, or patterns used to determine the need for action or further investigation, or to describe the level of confidence in a given results.

• Example

- Acceptability Levels
 - *Unsatisfactory* (range 0-40)
 - *Marginal* (range 40-70)
 - *Satisfactory* (range 70-100)



Measures and Indicator Values

| External Quality Requirements | Measure | EI value |
|---|---------|----------|
| Global Quality Indicator | | |
| 1 Usability | | |
| 1.1 Understandability | | |
| 1.1.1 <i>Icon/label ease to be recognized</i> | | 100% |
| 1.1.2 <i>Information grouping cohesiveness</i> | | 66% |
| 1.2 Learnability | | |
| 1.2.1 | | ... |
| 1.3 Operability | | |
| 1.3.1 <i>Control permanence</i> | | 100% |
| 1.3.2 <i>Expected behaviour</i> | | 50% |
| 2 Content Quality | | |
| 2.1 Content Suitability | | |
| 2.1.1 Basic Information Coverage | | |
| 2.1.1.1 <i>Line item information completeness</i> | 2 | 50% |
| 2.1.1.2 <i>Product description appropriateness</i> | | 50% |
| 2.1.2 Coverage of other Contextual Information | | |
| 2.1.2.1 | | ... |
| 2.1.2.2 <i>Return policy information completeness</i> | | 33% |



Concepts for Indicator/Evaluation

GLOBAL MODEL (syno Aggregation Model, Scoring Model or Function)

- algorithm or function with associated decision criteria that model a global indicator.

Ex. of global model to *Satisfaction Level of External Quality*

- Linear Additive Scoring Model

Partial/Global Indicator = \sum (Weight x Elementary Indicator)

$$P/GI = W_1 EI_1 + \dots + W_n EI_n$$

where $W_1 + \dots + W_n = 1$;



Measures and Indicator Values

| External Quality Requirements | Measure | EI value | P/GI value |
|--|---------|----------|---------------|
| Global Quality Indicator | | | 61.97% |
| 1 Usability | | | 60.88% |
| 1.1 Understandability | | | 83% |
| 1.1.1 Icon/label ease to be recognized | | 100% | |
| 1.1.2 Information grouping cohesiveness | | 66% | |
| 1.2 Learnability | | | 51.97% |
| 1.2.1 | | ... | |
| 1.3 Operability | | | 49.50% |
| 1.3.1 Control permanence | | 100% | |
| 1.3.2 Expected behaviour | | 50% | |
| 2 Content Quality | | | 63.05% |
| 2.1 Content Suitability | | | 63.05% |
| 2.1.1 Basic Information Coverage | | | 50% |
| 2.1.1.1 Line item information completeness | 2 | 50% | |
| 2.1.1.2 Product description appropriateness | | 50% | |
| 2.1.2 Coverage of other Contextual Information | | | 76.89% |
| 2.1.2.1 | | ... | |
| 2.1.2.2 Return policy information completeness | | 33% | |



Example: Content Suitability. Shopping Cart (Before)

cuspid.com Argentina, Miércoles 4 de Julio de 2007

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Suscripción
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Información acerca de Gastos de Envío y Tiempo de Entrega

Ir a la caja Presione este botón para informar la dirección de envío y medio de pago.

Annotations:

- 1.3.2 Expected behaviour of delete control
- 2.1.1.1 Line item information completeness
- 2.1.1.2 Product description appropriateness

GIS WEB

Example: Content Suitability. Shopping Cart (After)

cuspid.com Argentina, Miércoles 4 de Julio de 2007

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Información acerca de Gastos de Envío y Tiempo de Entrega

Annotations:

- 1.3.2 Expected behaviour of delete control
- 2.1.1.1 Line item information completeness
- 2.1.1.2 Product description appropriateness

GIS WEB

To Remark

Metrics are welcome when they are clearly needed and easy to collect and understand

Usefulness of Metrics

- Data coming from a measurement (objective, subjective)
- Mapping between an empirical world (entity attribute) to a numerical, formal world
- Heuristic operationalisation
- To serve as a “base” to Quantitative Methods for Evaluation and Prediction.
- A metric (and its measures) CAN NOT interpret by itself a calculable concept (Need of INDICATORS)



To Remark

Indicators are ultimately the foundation for interpretation of information needs and decision-making.

Usefulness of Indicators

- Mapping from a numerical world to another
- To serve as a base to quantify Calculable Concepts for an Information Need
- Indicators give contextual Information/Knowledge
- Indicators give contextual information for decision-making (Analyses and Recommendations)



References

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Agenda

- Characterizing Web 2.0 Apps
- Quality and Quality Models
- Specifying Information Quality
- Measuring and Evaluating Quality
 - Example: Content Suitability for a Shopping Cart
 - Attributes, Metrics and Indicators
- **Conclusions**



Conclusions

- We have proposed an integrated approach to specify quality requirements for functionalities and contents for WebApps
 - We have argued that the ISO **internal** and **external quality models** with the set of six characteristics, are not sufficient to specify WebApps' information quality requirements.
- We have proposed to include in both models the **content characteristic** and its sub-characteristics.
 - It is a general schema adaptable to all kinds of WebApps.
 - It means that the integrated model can be used with both the Web 1.0 and the Web 2.0 applications.
 - It is not defined for a particular type of domain.
 - It must be instantiated on the basis of some more specific parameters, e.g. questionnaire items or measurable attributes, and decision criteria.
 - Our integrated approach differs from the current SQUARE initiative
 - Too many standard documents!



Travel Social Network: Where Are You Now?

WAYN What is WAYN Watch the Video Take a Tour [Remember me](#) [Forgot your password?](#) [Log in](#) [Other login](#)

WAYN is a lifestyle and travel social network
connecting you with like-minded people wherever you are and whatever you're up for doing

Sign Up [Connect](#)

Full Name:
Email:
Password:
Birthday:

Sign Up

Plan
What you are up for doing with others

Find
People, places and activities around you

Meet
Like-minded people who share your interests

Share
Experiences, memories and tips with others



Conclusions

- We performed a preliminary qualitative study focused on the external quality of three WebApps of the tourism sector, namely:

www.opodo.com (Web 1.0 app.)
www.tripadvisor.com (some Web 2.0 features)
www.wayn.com (full Web 2.0)

- The process of content production in Opodo (Web 1.0 app) a top-down logic is pursued, it means that only content providers supply information to users.
- On the other hand, in TripAdvisor and Wayn (Web 2.0 apps) the process of content production becomes bottom-up; i.e. mainly users upload and update information. Moreover in Wayne the content is submitted to a social control mechanism.



Conclusions

- To the initial observations it was quite evident how non-structured information can be considered more accurate and suitable in 'tripadvisor.com' with respect to 'opodo.co.uk'.
 - Note that when we talk about non-structured information we refer for example to hotel review, location comment, etc.
- Conversely, for structured information –e.g. flight timetables, holiday price lists, among other, it can be considered more accurate and suitable in 'opodo.co.uk'.
- Lastly, in general terms we argue that the WebApp's content quality does not depend on the kind of applications –whether Web 1.0 or Web 2.0;
 - However, some kind of contents and services are more appropriate for Web 1.0 apps, while others for Web 2.0.
 - And some attributes should be customized to Web 2.0 applications



Questions ?

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