Designing with Priorities and Thresholds for Health Care Heterogeneity The Approach of Constructing Parametric Ontology

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Heterogeneous Sets of Requirements

The requirement document for each case reflects a different set of features and quality attributes comparing to others.

Need to evaluate multiple designs (and final products), compare them and aggregate them to a total.

A common platform is designed/being designed for all those products and future products in the ecosystem. The platform might take responsibility of providing some of the common features or facilitate some common quality attributes.

Q: What are the most common and highly demanded quality attributes or features for all products (they would become evaluation aspects for the designs and implementations)?

FI-STAR Project and its 7 Use-Cases

Tromsø, **Norway**

Tele-health network for Diabetes patients: The Norwegian Centre for integrated Care and Telemedicine (NST) in Tromsa, Norway, is a well established telemedicine centre providing care to a rural community north of the Arctic Circle. They will improve and extend the existing telehealth network for Diabetes patients, aiming at the development of smart phone based multi channeling allowing for streaming of different data at the same time (sensor data and audio and video).



2-D bar-coding for real time reverse medicament supply chain: Medichem is a SME Pharmacy whole seller in Leeds, UK, and will implement the 2-D bar-coding use case trial to offer real time reverse supply chain modelling to prevent error and counterfeiting and create interfaces to additional third party services.

Basque Country, Spain

New Interactive Future Internet based services for people with Mental Health problems: Osakidetra, in Spain, is a health random to the same or againstation providing healthcare for more than 2 Million people, and will implement its use case trial with the objective of improving access to the care and to apply the FI-PPF ore platform to other already existing services successively.

Emilia-Romagna, Italy

Provision of a network capable to connect different applications and devices: CUP 2000, in taly, ICT company of the Emilia Romagna region, develops new healthcare networks to allow general practitioners, specialists and healthcare professionals to share the assisted person's healthcare and disease data in real-time, allowing citizens to know and access healthcare data at anytime from anywhere. The use case will implement, in collaboration with Local Health Authorty necessary medical information is collected and elaborated according to specific logics, and to the potential of the FI-WARE platform, tested with battents affected by Chronic obstructive pulmonary disease (COPD).

Munich, **Germany**

Virtualization of operating theatre environments and real time data integration for monitoring and reduction of errors: Ninikum Rechts der Isar, in Germary, is the major teaching hospital for Technical University Munich, and will implement the virtualization of operating theatres use case trial to develop innovative methodologies for minimal invasive operating theatre environments.

Krakow. Poland

Interactive online facilities for access and quality of care: John Paul II Hospital, in Krakow, is one of the leading e-health applying hospitals in Poland, and will improve the access to and quality of care by designing improved interactive online facilities for their cancer patients, involving dedicated hardware (life monitoring sersors, tablets, cameras) and software tablets, cameras) and software control of the proposed control of the control of th



Bucharest, Romania

Online Cardiology service for people with heart failure: Liniversity of Medicine and Pharmacy "Carol Davia" from Bucharest, in Romania, through its teaching hospitals, it provides acute care to the 2 Million Inhabitants of Bucharest, and will establish the online cardiology service for people with heart failure, and in particular for people after myocardial infarction, by testing software applications in the integration experimentation site, real-time vital parameters internet-monitoring, improvement of physical training and improvement in secondary prevention programs.





Solution: Ontology Construction Out of the Quality Attributes

Explicitly specified qualities/entities in a domain/case can be communicated through an ontology.

Explicitly specified relations between qualities/entities can be captured in an ontology in a network model.

If we limit:

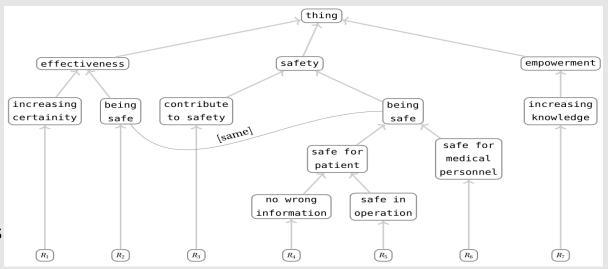
- the ontology form (e.g *rooted acyclic graph*): we can apply some specific traversing, construction, or aggregating algorithms over the ontology
- the relations to specific class (e.g. *subclass-superclass with weights*) we can gain some structural benefits (such as unification)
- the relations to specific quantitative and/or qualitative class (e.g. *subclass-superclass with weights*) deduce/infer some knowledge out of the network





Ontology Construction: How it Can Look (before assigning weights and fixing the wordings)

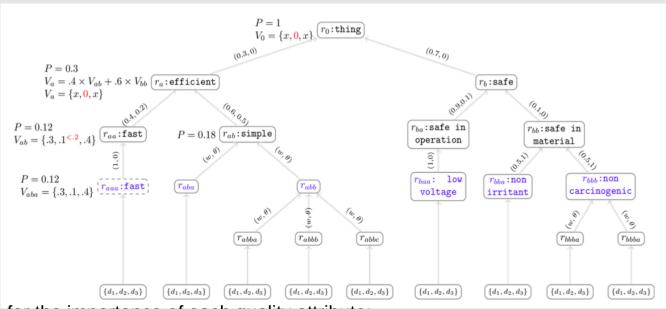
- Gather all quality attributes move them from top (thing node) to their right position or expand the ontology
- In our case (FI-STAR) we reached around ~400 nodes, gathered from 7 cases
- We had some minor complains from cases about attributes less relevant
- Changed wordings to better reflect subclass and superclass relations (e.g. safe to safety)







Double Weighting of Relations



Two dimensions for the importance of each quality attribute:

- Affirmative Contribution (X,...): how much does it **contribute** to the parent quality attribute? It also determines **P** value (value contribution) of each node.
- Negative Threshold (..., Y): below what threshold does it **defuse** the parent quality?
- Designs or implementations {d1, d2, d3} go up ontology to gain credits or being rejected (V)
- There can be a summarizing level (in blue)





Features and Limits

F: While originally a user based approach it can be extended by merging an ontology from a quality attributes specified in a model (we used the MAST model)

L: What if all the quality attributes end up as the first level nodes (low unification)?

L: What if it ends up in unbalanced levels in the tree (too generic ones same level as too specific ones), we injected some nodes between some parents/childs

L/F: Subjectivity in each subclass/superclass decision. The inevitable minimum?

F: Communication of regulations? Possibility of using upper ontologies? Possibility to rely on well developed biomedical ontologies?



Thanks!



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