The Semantics of Personalised Web Accessibility Assessment

Rui Lopes [*], Konstantinos Votis [† ‡], Luís Carriço [*], Dimitrios Tzovaras [†], Spiridon L. [‡]
{rlopes,lmc}@di.fc.ul.pt, {kvotis,Dimitrios.Tzovaras}@iti.gr, likothan@ceid.upatras.gr

ABSTRACT

This paper presents SAAF, a Semantic Accessibility Assessment Framework for personalised Web accessibility assessment procedures. We define four domains as a way to decouple general accessibility concepts and semantics (e.g., disabilities, device descriptions) from technology or assessment specific concepts. We leverage personalised Web accessibility by transforming questions such as "is this Web site accessible to me?" into rich-semantics queries on SAAF and integrate it into a Web accessibility evaluator.

Categories and Subject Descriptors

H.1.2 [**Models and Principles**]: User/Machine Systems—*Human factors*; H.5.2 [**Information Interfaces and Presentation**]: User Interfaces—*Theory and methods*

General Terms

Human Factors.

Keywords

Web Accessibility Semantics, Personalised Web Accessibility

1. INTRODUCTION

When viewed at a macroscopic scale, an interesting emergent property of the Web concerns that it constantly evolves towards being the most important entry point for information production and consumption by everyone. This purpose is defeated right from the start if a single user with a disability cannot access a given piece of information on a Web page. Thus, the sustainability of an accessible Web must be build around the purpose of all content producers, whether if it is for law abidance, market share, or any other reason.

Developers can leverage existing accessibility assessment tools to check a Web page's conformance to guidelines such as WCAG [2]. It is known that these guidelines target several disabilities (e.g., total blindness, colour blindness, hearing impairment, etc.), but this type of mapping is usually targeted to user groups [1] just at an analysis level, not to individuals and their particular requirements for assessment.

Other proposal, UGL, allows the specification of accessibility guidelines, which has been successfully applied in personalised Web accessibility studies [4]. While the proposed approach does provide answers to personalised Web accessibility, it limits studying semantics of personalised Web accessibility assessment such as guidelines inspection.

On the ontologies side, work has already explored accessibility concerns. These efforts focus on covering end user requirements for accessibility. ICF [5] has been a common ground foundation to describe disabilities, e.g., in multimodal interaction design [3].

To mitigate this, we propose SAAF, an ontological framework for personalised Web accessibility assessment, and apply it to Web accessibility evaluators.

2. WEB ACCESSIBILITY SEMANTICS

We have created SAAF, the Semantic Accessibility Assessment Framework, in order to explicitly support the semantic layers that are present on accessibility assessment procedures. The main goal of SAAF is the separation between generalised accessibility concepts and the details of Web accessibility assessment, by formalising conceptual information about: (1) users, devices, and the relationship between them in the context of accessibility; (2) Web accessibility assessment standards and related evaluation techniques; and (3) the correspondence between all concepts.

This framework has been devised to be applied in different accessibility assessment scenarios. Hence, we defined two dimensions, *meta* and *instance*, which are cross-cut by *concepts* and *semantics* dimensions. This forms a four-dimension framing of accessibility:

Generic ontologies provide a set of *meta concepts* related to accessibility that are independent from particular technologies. Examples include the description of users and devices, or general concepts that are present in every type of accessibility assessment procedure.

Mapping describe the *meta semantics* of accessibility assessment. These rules capture constraints, dependencies, and limitations between different generic terms.

[*]LaSIGE/University of Lisbon, Campo Grande, Edíficio C6, 1749-016 Lisboa, Portugal

[†]CERTH/ITI, Thermi-Thessaloniki, GR-57001 Greece

[‡]Pattern Recognition Laboratory, Computer Engineering and Informatics, University of Patras

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Domain-specific ontologies provide *instance concepts* within the context of a particular technology or standard (e.g., WCAG 2.0 guidelines and corresponding success criteria). These concepts can be derived both from instancing meta concepts (e.g., a particular assessment technique for HTML images) or by providing domain-specific concepts (e.g., WCAG conformance levels).

Rules describe the *instance semantics* that bridge the gap between the *meta* dimension and *instance* concepts, such as binding a disability to a set of WCAG success criteria.

Having a knowledge base for Web accessibility, there must be a way to extract accessibility assessment information based on semantic accessibility requirements (e.g., "*is this Web page accessible to me?*"). These questions can be made *before* or *after* an evaluation process, depending on their semantics. We used SPARQL to translate them into machine readable forms, to be directly used in SAAF.

Regarding pre-evaluation filters, they are used for the selection of a subset of tests according to a specific criterion (e.g., personalisation). For instance, in Figure 1, the criterion is everything targeted to a particular disability for AA level compliance of WCAG 2.0:

```
SELECT ?test
WHERE {
  ?test rdf:type saaf:Checkpoint.
  ?test saaf:verifiedThrough wcag:wcag2.
  ?test wcag:priority ?priority.
  wcag:levelAA wcag:conformance ?priority.
  saaf:colorBlind saaf:disabilityMapping ?test.
}
```

Figure 1: Meeting AA level WCAG 2.0 compliance

Post-evaluation filters act on checking if the resulting outcome from accessibility assessment meets some kind of expectation. This can be formulated by means of a SPARQL query and matched against the assessment result. An example is found in Figure 2, where a SPARQL query answers the question "*which disabilities are taken into account in this Web page?*"

```
SELECT ?disability
WHERE {
  ?test rdf:type saaf:Checkpoint.
  ?disability rdf:type saaf:Disability.
  ?disability saaf:disabilityMapping ?test
  FILTER (?test ev:evaluation ev:passed)
}
```

Figure 2: An evaluation's corresponding disabilities

3. PERSONALISED ASSESSMENT

On top of the SAAF framework we have implemented an accessibility evaluator that leverages its set of analysis tools (taxonomies, mappings, rules, and queries). The first step in the creation of an semantics-aware accessibility evaluator concerns binding domain-specific concepts and assessment software components. Opposing to the typical monolithic approach of accessibility evaluators, personalisation requires that only a subset of tests must be run. We have leveraged Java's meta-programming concepts to define these bindings.

Test criterions belonging to the same accessibility guidelines share a common namespace within their enclosing ontology, and are identified with URIs. The identification of each criterion is, then, the conjunction of a namespace and an end point identifying the criterion within this namespace. In Figure 3 we exemplify how to use these annotations:

```
@BindNamespace(
  namespace="http://example.com/ex.owl"
)
public class ExampleModule {

  @BindTest(endpoint="#Test_01")
  public Object TestEX_01(Object app) {}

  @BindTest(
    namespace="http://example.com/ex2.owl",
    endpoint="#Test_01"
  )
  public Object TestEX2_01(Object app) {}
}
```

Figure 3: Bindings in a software component

4. CONCLUSIONS AND FUTURE WORK

In this paper we presented SAAF, a framework to detail Web accessibility knowledge which takes into account semantic and personalisation capabilities. By clearly separating generic accessibility from domain-specific issues, Web accessibility becomes simpler to use independently from particular guidelines and, consequently, personalisation can be further explored with appropriate set of guidelines. We have used the knowledge built into SAAF as the brain of an evaluation software capable of running personalised accessibility assessments based on semantic queries.

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6. REFERENCES

[1] G. Brajnik. Web Accessibility Testing: When the Method Is the Culprit. In *Computers Helping People with Special Needs*, pages 156–163. 2006.

[2] B. Caldwell, M. Cooper, L. Reid, and G. Vanderheiden. Web Content Accessibility Guidelines 2.0. W3C Recommendation, World Wide Web Consortium (W3C), December 2008. `http://www.w3.org/TR/WCAG20/`.

[3] Z. Obrenovic and D. Starcevic. Modeling Multimodal Human-Computer Interaction. *Computer*, 37(9):65–72, 2004.

[4] M. Vigo, A. Kobsa, M. Arrue, and J. Abascal. User-tailored web accessibility evaluations. In *HT '07: Proceedings of the 18th conference on Hypertext and hypermedia*, pages 95–104. ACM, 2007.

[5] World Health Organisation. International Classification of Functioning, Disability and Health. Accessed July 28, 2008 from `http://www.who.int/classifications/icf/site/`.