

# Adaptive Applications: Formal and Informal Definition

Ammar Memari<sup>1</sup> and Jorge Marx Gómez<sup>1</sup>

Carl von Ossietzky University of Oldenburg, Ammerländer Heerstr. 114-118 D-26129  
Oldenburg, Germany

`ammar.memari@uni-oldenburg.de`,

`jorge.marx.gomez@uni-oldenburg.de`,

WWW home page: <http://vlba.uni-oldenburg.de>

**Abstract.** Even though different aspects of adaptivity play a major role in today's software, the term "Adaptive Applications" is not well defined in literature, and is usually confused with other terms referring to other sorts of applications. In this paper we try to de-fuzzify the term and capture common properties of these applications into an informal definition. Then come up with a formal definition through mapping application architecture to a suggested reference model.

**Keywords:** Adaptive applications, reference modeling, rough sets

## 1 A Formal and an Informal Definition

For the informal definition we start by listing some well-known applications in different application areas and then start clustering them up to reach several categories thereby defining categories such as collaborative filtering, context aware, recommendation systems etc. Distinguishing in the process between adapted, adaptable and adaptive applications [5]. Following also the model of [1] and [2]. Ending up eventually with a matrix of applications and their different attributes related to adaptation from different dimensions: Sensitivity to: user, content, context and neighborhood Object of adaptation: content, presentation or navigation [3]. Matchmaking and relations: content-content, user-content, user-user, content-context and user-context relations [4]. Depth of adaptation: adapted, adaptable or adaptive [5] both on the first and second order Conceptual space: ability of application to navigate the conceptual space using a single-faceted or a multi-faceted hierarchy or ontology Business constraints: respect of best practice business constraints by the adaptive application like privacy and scrutability [6, 7] Adaptability of application architecture: a modular application architecture is more adaptable than a non-modular one.

For the formal definition we start by listing related formal models especially in the field of adaptive hypermedia and adaptive computing. Such as the AHAM model of [8], its enhancement by [9] and further extensions done by [2]. Other non-Dexter-based models will also be discussed such as the LAOS model by [1]. Sub-models used commonly for building these models will be listed and

defined extending thereby the works of [10]. We will then discuss needs for future generations of adaptive applications trying to capture their properties as well into our final model. Ending up with a set of requirements. In the end we describe a formal reference model using UML (Unified Modeling Language) following the notation of [11] with which we capture the defining attributes of adaptive applications. The model will be used for determining the lower approximation of the adaptive applications set by determining the minimal components/attributes that should be mapped into the application component in order for it to be classified as an adaptive application. Moreover, a higher approximation will be given determining thereby a model for a full-fledged adaptive application that would be exemplified in the end with the [www.jinengo.com](http://www.jinengo.com) integrative adaptive navigation application. This application will serve as a proof of applicability and viability of proposed model and ideas, and will help evaluate the model in the end.

## References

1. Mooij, A.D., Cristea, A.I.: LAOS: layered WWW AHS authoring model and their corresponding algebraic operators. In: WWW03 The Twelfth International World Wide Web Conference, Alternate Track on Education, Budapest, Hungary (2003)
2. Knutov, E.: Generic Adaptation Framework for Unifying Adaptive Web-based Systems. PhD, Technische Universiteit Eindhoven, Eindhoven NL (2012)
3. Knutov, E., De Bra, P., Pechenizkiy, M.: AH 12 years later: a comprehensive survey of adaptive hypermedia methods and techniques. *New Review of Hypermedia and Multimedia* **15**(1) (2009) 5 – 38
4. Memari, A., Wagner vom Berg, B., Marx Gmez, J.: An agent-based framework for adaptive sustainable transportation. In: 20th IEEE International Workshops on Enabling Technologies: Infrastructures for Collaborative Enterprises, WETICE 2011, Paris, France, 27-29 June 2011, Proceedings, Paris, France, IEEE Xplore (June 2011)
5. Lenz, C.: *Empfaengerorientierte Unternehmenskommunikation Einsatz der Internet-Technologie am Beispiel der Umweltberichterstattung*. PhD thesis, Eul, Lohmar; Koeln (2003)
6. Kasanoff, B.: *Making It Personal: How To Profit From Personalization Without Invading Privacy*. 1st edn. Basic Books (November 2001)
7. Kay, J.: Scrutable adaptation: Because we can and must. In: *Adaptive Hypermedia and Adaptive Web-Based Systems*. Springer Berlin Heidelberg (2006) 11–19
8. De Bra, P., Houben, G., Wu, H.: AHAM: a dexter-based reference model for adaptive hypermedia. In: *HYPERTEXT '99 Proceedings of the tenth ACM Conference on Hypertext and hypermedia : returning to our diverse roots: returning to our diverse roots*, Darmstadt, Germany, ACM (1999) 147–156
9. Balík, M., Jelínek, I.: Modelling of adaptive hypermedia systems, Bulgaria (June 2006)
10. Ghali, F., Cristea, A.I.: Social reference model for adaptive web learning. In Spaniol, M., Li, Q., Klamma, R., Lau, R.W.H., eds.: *Advances in Web Based Learning ICWL 2009*. Volume 5686. Springer Berlin Heidelberg, Berlin, Heidelberg (2009) 162–171

11. Favre, J., NGuyen, T.: Towards a megamodel to model software evolution through transformations. *Electronic Notes in Theoretical Computer Science* **127**(3) (April 2005) 59–74

