

Keynote talk: Augmented, Adaptive, Accessible, and Inclusive Things

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ABSTRACT

In this keynote talk, I will illustrate the main principles of the W3C Web of Things (WoT) paradigm and I will discuss the issue of enhanced accessibility through the WoT and adaptation techniques.

In this new age of the Internet of Things (IoT), people and things are increasingly immersed in a computing environment that is aimed to simplify and improve daily activities. Meanwhile, the Web is evolving, application logic and data is increasingly distributed, the new rich web applications and liquid software are offering enhanced user experience [3]. Web-based methods and open standards are seen as a mean to augment the interaction with things and to increase the interoperability across IoT platforms, respectively [2]. In 2017 the W3C launched the Web of Things (WoT) Working Group aimed to provide standards that describe things as a basis for semantic interoperability and discovery and that simplify application development through a common interaction model independent of the underlying protocols. The WoT is based upon the fundamentals of Web architecture. WoT applications are programs that either expose a thing and implement a thing's behavior, or interact with a thing using APIs for control of sensors and actuators and access to associated metadata. The Thing Description (TD) is a central building block of the WoT; its core component is the interaction model defined in terms of properties, actions and events, whose semantics is specified in the TD vocabulary. In the WoT paradigm, things are virtual representations of physical digital objects but also of non-digital things, such as people, places, and everyday objects. This is an extraordinary opportunity to increase accessibility and usability of real world objects. The idea is that through the virtualization of physical objects, even (digital or non-digital) objects which are not natively accessible and inclusive, can become accessible if proper adaptations are performed, for instance by changing the user interface and the interaction modalities in order to fit the user's needs [4–6]. This would enable an open ecosystem of digitally augmented physical objects that I like to call **AAAI Things** (Augmented, Adaptive, Accessible and Inclusive Things) with a clear reference in the acronym to the role of AI¹. AI is indeed a key component for the adaptation task, aimed to tune and personalize the user interface and the interaction with the objects. Current W3C/WAI standards offer support for accessibility and universality. Moreover, Accessibility APIs are used to communicate semantic information about the user interface to assistive technology software used by people



with disabilities. However, this could be not enough to support fine-tuned adaptations. Besides the fact that the standards above might require extensions to manage accessibility features on IoT devices [1], a further problem is that disabilities are heterogeneous and often a subject has more than one disability, which requires specific adaptations. This is also the case of cognitive impairment, where for instance content adaptation might be required². To address this issue, already in 2014 [2] we proposed an approach that virtualizes physical objects on the WoT and adapts the interaction with the virtual side of cyber-physical objects in order to make physical objects accessible. Then, in [3] we also described how our approach of object virtualization and annotation could exploit and extend the Global Public Inclusive Infrastructure (GPII), which enables the transfer of platform-independent user preferences and needs from one device to another via a cloud service. Much research must still be done to finalize WoT standardization and to update web accessibility standards. Personalization for the WoT is still at early stage as well, but a fast development is expected, driven by the rapid evolution of the IoT.

CCS CONCEPTS

• **Human-centered computing** → **Interactive systems and tools**; *Ubiquitous and mobile computing*.

KEYWORDS

web of things, adaptive systems, linked data, accessibility

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²<https://www.w3.org/TR/coga-gap-analysis>

¹AAAI (Association for the Advancement of Artificial Intelligence).

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BIOGRAPHY

Ilaria Torre, PhD, is Assistant Professor at the Department of Informatics, Bioengineering, Robotics and Systems Engineering in Genoa University, and an Advisory Board member of the PhD School in Digital Humanities. Since her PhD dissertation in 2003 on User Modelling and Adaptive Systems, her main research interests include intelligent user interfaces, adaptive systems, recommender systems and ubiquitous systems. Over the years, she worked on the application of HCI and AI in various fields, including on-board services and tourist-cultural mobile guides, technology-enhanced learning and privacy management. Ilaria is author of a book and published over 70 papers in international journals and conferences. She served as TPC member of a number of conferences including ACM IUI, ACM UMAP, Interact, and as reviewer for important journals. She has been invited speaker at Ubiquitous User Modeling workshop (2011) and Social Media and Data Science conference (2017) at Haifa, Israel. Recently, she co-organized IUadaptMe Workshop at ACM UMAP 2018, PALE at AIED 2018, IoTAAL at the IEEE Global IoT Summit 2017 and SmartLearn at ACM IUI 2017. In 2016

she was co-Chair of the Workshops and Doctoral Consortium at the AI*IA Conference. At present, she is Guest Editor of a Special Issue for the IEEE Transactions on Learning Technologies Journal and co-Chair of the Student Consortium at the ACM IUI Conference on Intelligent User Interfaces 2019.

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