

Scenario-Driven Development of *Context-Aware* Web Agents Frameworks

Alexandru Sorici

National University of Science and Technology POLITEHNICA of Bucharest
alexandru.sorici@upb.ro

1 Position Statement

My approach to the Web Agents Community comes from the domain of Ambient Intelligence (AmI) and, more specifically, from the part of it which considers the environment as *proactive* in human-centered interactions. My main interest in the Ambient Intelligence domain is that of organizing and enabling *required* and *desired information flows* in a timely and application-specific manner - in other words, the design of *context-management systems*. [2,8].

Scenario-Driven Development One thing that becomes apparent in AmI and context management is that there is no "one size fits all" framework capable of addressing the diversity of application requirements. Consequently, my first position is that the Hypermedia MAS community needs to develop an *impactful scenario-based roadmap* of development that can bring about "critical mass" demonstrator applications for several application *classes*:

- **Contained human - software-agent teams:** The focus of this class of applications is on enabling *goal-driven* interactions between human and software agents on the web, in a way that humans are already accustomed to do (e.g. through means of social media and web interfaces). Challenges in this application class include: (i) modeling of small scale socio-technical networks of people, software agents and their *digital environment* to enable personalized interactions, (ii) transforming *intent-based* assertions into actionable plans across a variety of Web APIs. I believe a key aspect in this class of applications will be the leveraging of foundational neural models for natural language processing (LLMs) that are given the capability to interact with structured knowledge (ontologies and RDF graphs, API descriptions) and use the planning and task solving capabilities inherent in natural language based inference [5,6,1].
- **Open Ecosystems for end-user mashup of agent services in decentralized data and control setups:** this class of applications envisions an "evolutionary" step of the If-This-Then-That market place. The main difference from the previous class is that here humans are at the forefront of *designing* the interaction. In addition, the agent and environment services that can be combined may not be known in advance, but discovered dynamically. A key challenge in this regard is how to use the web architecture

to *advertise* both data and services in a contextually appropriate proactive manner to the agents seeking to compose a functionality flow.

- **Large scale B2B services:** An analysis of the Web’s history of becoming what it is today [3] highlights that the Web exhibits many instances of networks within a network, the most prominent example being social media. However, I believe the same to be true in business-to-business domains such as smart manufacturing and logistics, energy management and smart grids, intelligent traffic management and autonomous driving, areas which have traditionally benefited from advances in the multi-agent literature. A demonstrator framework in one of these domains, or other similar ones, is essential to spur interest in web agent development.

Contextualized Interactions A thread that seems to bind the previous scenario-driven development discussion is that the environment in which human and software agents operate needs to facilitate an *interest / focus* driven access to the *web of data* and the *web of services*. Frameworks that will enable development of Hypermedia MAS need to leverage the Web architecture to build mechanisms that can *identify, structure* and *signal/advertise* the *data* and *capabilities* that are relevant within *the context* of an interaction. As such, the attributions of context-management mechanisms within an HMAS range from defining access control [7], to indexing data and capabilities, to defining situations where a flow of information or service affordances need to be advertised.

As an enabler (middleware) functionality, the interest in developing context management in HMAS using a scenario-driven roadmap of research intersects with several other position statements: making the environment a first-class abstraction in the principled design of HMAS, leveraging affordance theory [4] to dynamically filter and guide the interactions of software-agents in the environment or with a human agent (HCI), finding and promoting the resources and representations for that enable HMAS functionality over the web, or facilitating coordination in swarms of agents.

References

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