Ontology for Smart City

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Abstract

In recent decades, the concept of Smart City has undergone considerable development. This development is mainly due to the increasing urbanization of society (by 2050 the world's population living in urban areas will rise to 67%) and to the progress and massive use of information and communication technologies (ICT). Cities are complex systems. Their rapid urbanization is the source of many issues that affect the quality of life of their citizens: transportation and traffic jams *("in some major cities, residents will spend four years of their lives trying to find a parking place"* Smart cities: understanding the challenges and opportunities, P. Simpson), resources management (water, electricity), pollution and waste management, community services (hospitals, schools, amenities, social services…), etc. They constitute one of the greatest challenges to our future life: "*The accelerating growth of cities and their disproportionate consumption of physical and social resources is assessed by the United Nations to be the greatest challenge to mankind since we became social*" PAS 180:2014, Smart cities – Vocabulary, BSI (Publicly Available Specification). The smart city concept, which appeared in the 1990s following the Kyoto Protocol, is a response to these challenges. The concept of Smart City embraces several definitions relying on different meanings of the word "smart" (intelligent, digital, sustainable, knowledge, ubiquitous, etc.), and there is not yet one definition universally accepted. Let us quote the International Telecommunication Union which defines a smart sustainable city as "*An innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social and environmental aspects*".

Smart City is based on a complex architecture of heterogeneous systems that must communicate and collaborate to achieve the objectives set. To this end, Smart City makes massive use of information and communication technologies (ICT) like networks and Internet of Things. Connectivity, open data and sharing data are put forward, rising at the same time terminological and standardization issues: there is neither communication nor sharing knowledge without a common understanding of the terms exchanged. In this context, Ontology coming from Artificial Intelligence (Knowledge Representation), understood as a "*specification of a conceptualization*" (Gruber) or as a "common vocabulary whose terms are formally defined" has become a cornerstone of Smart City. Ontology will provide a common understanding and standardized vocabulary for representing cities-related facts, services, organization, flow of events and key performance indicators, allowing also alignment of different points of view (ontologies). Ontology also enables and facilitates interoperability and communication between the heterogeneous systems which compose a Smart City, providing interchange formats (ISO or W3C compliant) and formal definitions (for example in Description Logic) allowing reasoning for intelligent data processing. This talk will be illustrated with some standards for Smart City, e.g. ISO 37122 standard on "Sustainable development in communities - Indicators for Smart Cities", PAS 180:2014 on "Smart cities – Vocabulary" from BSI, (British Standards Institution), IEC 60050-831 on "Smart city systems" as well as with some examples of ontologies like SCRIBE, a semantic model of events, and "Open 311 Ontology", an ontology for publishing a city's non-emergency events ("a fundamental aspect of a smart city is to integrate and combine the data coming from various sources and places").

Biography

Christophe Roche is Full Professor in Artificial Intelligence at University Savoie Mont-Blanc (France) in charge of the Condillac Research Group in "Terminology and Ontology". Winner in 2017 of a Talent Project of the Shandong Province and awarded with the Qilu Prize of the Shandong Province in 2018, Christophe Roche is the Dean of the Knowledge Engineering and Terminology Research Centre at University of Liaocheng (China) http://ketrc.com/ . He is also Researcher & Lecturer at University NOVA of Lisbon (Portugal). Christophe Roche is an ISO expert on Terminology (Project leader of the ISO 1087-1 Standard) and the Chairman of the French Committee of Standardization on Terminology (AFNOR, X03A Commission). http://christophe-roche.fr/

His main topics of research are Symbolic Artificial Intelligence (Knowledge Representation and Ontology) and Terminology. Christophe Roche has participated in several European and industrial Projects (FP 4, Eureka, FP 7, Interreg III, Interreg IV, Tempus, H2020) in Terminology and Ontology mainly for IT applications: Knowledge Management, Multilingual Terminology, Digital Humanities, Cultural Heritage, etc.

In 2007 Christophe Roche set up the International TOTh Conferences ("Terminology & Ontology: Theories and applications), and in 2011 the Workshop TOTh series: http://toth.condillac.org/

He has published and given more than 150 publications and invited talks