Deliverable from the COST Action CA19134 "Distributed Knowledge Graphs"

Second Working Group Activity Report

Abstract:

This report summarises working-group specific activities as conducted by the working groups of COST Action CA19134 "Distributed Knowledge Graphs" in the second half of the Action's funding period. As such, the report does not cover an in-depth treatment of activities that the Action ran as a whole such as plenary meetings, talks, and short-term scientific missions (STSMs).

WG1

As of October 11, 2024, the working group consists of 73 members (as registered in the e-Cost platform), and 89 people are subscribed to the mailing list of the working group.

Following the first workshop on federated querying, which was held in Izmir, Turkey on April 25-27, 2023, WG1, in collaboration with WG4, organized another workshop focused on enhancing user experience and efficiency in querying federated data sources. Specifically, we issued a call for contributors to address the following challenges: Complex Query Authoring, Data Source Discovery, and Federated Data Integration. This hackathon-style workshop took place in Malaga, Spain between June 26-28, 2024, where invited teams worked together to develop or refine their ideas and prototypes in response to the call. At the end of the workshop, 24 participants presented their projects and contributed to a joint report. These 12 projects ranged from automated discovery of interfaces and LLM-based translation of questions into queries, to provenance-based result explanations, visual query editing, and improved query plan visualization.

Following the 'Workshop on Metadata 4 DKG (Metadata Authoring for Distributed Knowledge Graphs),' which took place in Lyon from May 18 to May 20, 2022, we identified a minimal set of metadata elements for knowledge graphs (KGs) and re-examined cardinality constraints. WG1 published this metadata specification for KGs as SHACL shapes, which can be accessed at the following link: https://maastrichtu-ids.github.io/kg-metadata/ .

We also approached the W3C Knowledge Graph Construction Community Group on possible collaboration on the development of the KG Metadata specification. We engaged with the community group to jointly decide what metadata elements should be included when producing knowledge graphs. The work is in progress and we plan to publish the specification for broader adoption.

Another activity of the working group as a whole during the second reporting period was to contribute to the "Guidelines and Best Practices", the "Research Agenda", and the "Academic Curriculum" deliverables of the Action.

WG2

As of October 11 2024 the working group 2 Consumers of Distributed Knowledge Graphs (WG2) consists of 49 members (as registered in the e-Cost platform), and 83 people are subscribed to the mailing list of the working group.

The major activity of WG2 consisted of setting up the Solid Symposium series. The goal of the symposium is to provide a forum for early adopters from companies and public administration, researchers and the community at large to discuss the current state of the art around [Solid (Social Linked Data)](#), learn about best practices in enterprise applications and exchange ideas for further developments. Solid provides an infrastructure for data portability and data sovereignty, which are important for [Europe's strategic autonomy in the digital field](#).

In the first Solid Symposium (https://solid.ti.rw.fau.de/public/2023/solid-symposium/) held March 30-31, 2023, Nuremberg, Germany, 70 participants from around Europe attended. A video is available at https://www.youtube.com/watch?v=3-PzsOIUN98.

The symposium focused on exploring various aspects of decentralised web technologies, with a particular emphasis on the Solid ecosystem. Key themes included:
1. Decentralised healthcare solutions and applications
2. Personal knowledge graphs and their potential
3. Trust mechanisms in decentralised knowledge systems
4. Challenges and opportunities in implementing Solid technologies
5. Identity management within the Solid framework
6. Business applications and implications of Solid

In the second Solid Symposium (https://events.vito.be/sosy2024) held May 2-3 2024 in Leuwen, Belgium, over 100 participants from around the world attended. Key themes included:
1. Decentralisation and data sovereignty
2. Social and ethical implications of web technologies
3. Public sector applications and governance of decentralised systems
4. Healthcare applications of Solid
5. Technical challenges and innovations in decentralised data spaces
6. Developer experience and ecosystem growth
7. Privacy and data protection in Solid systems
8. Interoperability and data sharing across sectors

The event featured a mix of keynote presentations, workshops and specialised sessions. Keynotes covered topics ranging from socially-aware web design to public sector data spaces and technical aspects of graph data sharing.

Practical sessions included a Solid tutorial, discussions on developer experience, and explorations of real-time capabilities in Solid. The symposium also addressed specific application areas, such as healthcare and public administration, highlighting the growing interest in practical implementations of Solid technologies.

The third Solid Symposium will be held April 2025 in Leiden, The Netherlands.

WG3

As of October 11, 2024, working group 3 on prosumers of distributed knowledge graphs has 34 members registered in the e-Cost platform, and 68 people are subscribed to the mailing list of the working group.

A large part of the activities of working group 3 in the period related to autonomous systems that produce and consume distributed knowledge graphs, especially with the aim of determining how to interact with web resources as well as other prosumers. These activities led to joining and shaping the community around Autonomous Agents on the Web who organised a Dagstuhl seminar in February 2023. This seminar was a followup of an online seminar that happened during the previous period.

In March 2023, a W3C community group on *Autonomous Agents on the Web* was created, to which many COST participants and others participants from the Dagstuhl seminar joined. The group meets online every other week. Web agents can acquire autonomy by navigating web platforms and web resources according to structured descriptions that are interlinked. From a knowledge graph describing the possible actions and interactions at a point of entry, agents can take an informed decision on the next course of actions and find other knowledge graphs elsewhere (via hypermedia links) describing other web resources. In turn, agents can communicate with each other, or with online artefacts, by publishing knowledge graphs. Additionally, web agents signal their online presence by having profiles published in the form of knowledge graphs.

In August 2024, a workshop was organised in Dublin on *Autonomous Agents as prosumers of Distributed Knowledge Graphs* where 12 people met. Prior to the workshop, participants could submit position statements shared with all other participants. The morning sessions were dedicated to presentations of the position statements, demos of tools and general introduction of everyone, to help identify who works where and on what topics. The afternoon session was about working on a use case where an autonomous vacuum cleaner is designed to be able to enter any environment that has a digital hypermedia space where knowledge graphs can be found. By interacting with the knowledge graphs available from the environment, and/or describing the environment, the vacuum cleaner has to decide on its own when it can clean the place while not disturbing the occupants.

Working group 3, like the other WGs, also contributed in this reporting period to the "Guidelines and Best Practices", the "Research Agenda", and the "Academic Curriculum" deliverables of the Action.

WG4

As of October 11, 2024, the working group consists of 43 members (as registered in the e-Cost platform), and 83 people are subscribed to the mailing list of the working group.

A major strand of activities of the WG during the second reporting period of the Action was related to the topic of querying federations of knowledge graphs (KGs), for which WG members co-organised two three-days hackathon-style events in collaboration with WG1. The first of these hackathons took place on April 25-27, 2023, in Izmir, Turkey. The overall objective of this event was to achieve an understanding of the challenges and of use cases of federated query processing over KGs. One of the major outcomes of the event was the realisation that the creation of queries for a federation of KGs and the setup and use of existing query federation systems are very challenging for users. As a consequence, a second hackathon was organised with the objective to work specifically on approaches to enhance the user experience. This second hackathon took place on June 26-28, 2024, in Malaga, Spain. More details about these events are available above in the section of WG1.

The subgroup of WG4 participants interested in privacy and security concerns in ecosystems of knowledge graph producers and consumers, as had formed already at the beginning of the first reporting period, continued its activities during the second reporting period. First, a paper about potential privacy and security issues in decentralised architectures of personal knowledge graphs (with the Solid ecosystem as the major subject of study) that members of the subgroup had submitted for review to the 2023 ACM/SIGAPP Symposium on Applied Computing (SAC) was refined after being rejected from the conference, and then made available on the arXiv e-print repository. Thereafter, several other research papers co-authored by participants of the subgroup were published throughout the second reporting period. The most notable of which was a paper published in the 2024 ACM Web Conference that evaluates specifications from the Self-Sovereign Identity paradigm to construct an authentication protocol for the Web.

The privacy & security subgroup also organised two events. The first of which was another three-day workshop on "Privacy Issues in Distributed Social Knowledge Graphs", as a follow up to a similar workshop organised already during the first reporting period. The follow-up workshop now took place in Salerno, Italy, from February 13 to February 15, 2023. This workshop had 14 on-site participants and its main objective was to provide a platform for PhD students and other researchers to explain and share in detail their solutions to privacy problems identified in the first version of the workshop. The first day of the workshop consisted mainly of talks by the participants. The second day then focused on discussions around human-centred privacy, and further talks from participants. On the third day, the participants discussed potential collaborations on research papers and projects (and, as a social event, visited Pompeii).

The second event that participants of the privacy & security subgroup organised during the second reporting period of the Action was the privacy track at the 2024 Solid Symposium, which took place on May 3, 2024, in Leuven, Belgium. Several of the group members had research papers in this track, which they presented at the event.

Another activity of the working group as a whole during the second reporting period was to contribute to the "Guidelines and Best Practices", the "Research Agenda", and the "Academic Curriculum" deliverables of the Action.