SC-PROV: A Provenance Vocabulary for Social Computation

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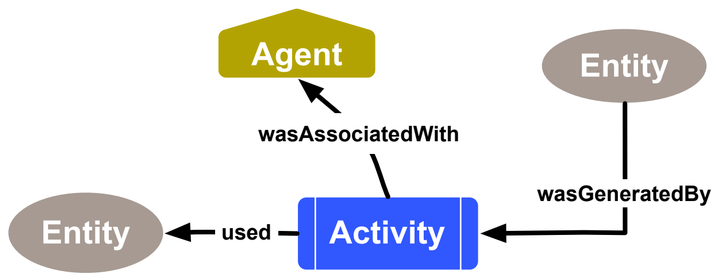
Background

Social Computation: "a computation for which an executable specification exists, but the successful implementation of this specification depends upon computer-mediated social interaction between the human actors in its implementation" [1].

Provenance: "information about entities, activities, and people involved in producing a piece of data or thing" [2].
W3C Provenance Working Group

PROV [2] is a set of W3C recommendations for interchange of provenance on the web.



1. D. Robertson and F. Giunchiglia. Programming the social computer. Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences, 371(1987), 2013.
2. L. Moreau, and Paul Groth. "Provenance: An Introduction to PROV." Synthesis Lectures on the Semantic Web: Theory and Technology, 1-129, 2013.

Problem

The use of humans in social computation introduces issues associated with their reliability and trustworthiness, and also with the quality of the results they generate. Social computation systems therefore need to be able to reason about such aspects. However, this reasoning is dependent on the information available about the computation.

While PROV-O can be used to document retrospective provenance (such as execution traces of workflows) this would not include details of why or how a workflow was expected to execute.

SC-PROV

SC-PROV is an extension of PROV-O[1] and P-PLAN[2] to enable descriptions of preconditions, postconditions and incentives associated with a social computation task as part of the social computation plan. In addition, SC-PROV enables such concepts to be mapped to a provenance record describing the execution trace.

[1] http://www.w3.org/TR/prov-o/ , [2] http://vocab.linkeddata.es/p-plan/

Social Computation

Problem
A real-time image of a travel disruption is required.

Expected Solution
An image from the site of the disruption

included in

described by

Executable Specification

- Provide participants with the location of a travel disruption.
- Allow participants to upload an image of the disruption.
- Check if participant's location was less than 200 metres from the disruption when the picture was taken.
- Award a £1 voucher to the participant if at least one other agent confirms the image is of the disruption.

enacted as

Social Computation Execution

documented by

Prospective Provenance

p-plan:correspondsToVariable

sc-prov:Problem

sc-prov:hasParameter

Participant's location < 200 metres from disruption (sc-prov:Precondition)

sc-prov:hasParameter

GPS location of a disruption (p-plan:Variable)

sc-prov:Solution

sc-prov:hasRole

GPS location of participant (p-plan:Variable)

p-plan:hasInputVar

sc-prov:hasPrecondition

p-plan:hasInputVar

Image (p-plan:Variable)

sc-prov:hasRole

Problem statement (p-plan:Variable)

p-plan:hasInputVar

Receive image (p-plan:Step)

p-plan:hasOutputVar

sc-prov:hasParameter

Validation (p-plan:Variable)

p-plan:isStepOfPlan

sc-prov:hasIncentive

sc-prov:hasPostcondition

Image confirmed by one other agent to be of the travel disruption (sc-prov:Postcondition)

Obtaining image of a disruption (p-plan:Plan)

p-plan:correspondsToStep

£1 voucher (sc-prov:Incentive)

sc-prov:dependsOn

sc-prov:hasParameter

p-plan:correspondsToVariable

sc-prov:isInstanceOf

p-plan: correspondsToVariable

"Provide an image of a travel disruption ..." (p-plan:Entity)

Bob (prov:Agent)

Crowdsourcing platform (prov:Agent)

£1 voucher for Bob (sc-prov:Reward)

prov:influencedBy

Alice (prov:Agent)

prov:wasAssociatedWith

prov:wasGeneratedBy

prov:wasAssociatedWith

prov:wasAttributedTo

prov:wasAssociatedWith

prov:used

Image upload (p-plan:Activity)

Reward evaluation (p-plan:Activity)

prov:used

Confirmation image is of the disruption (p-plan:Entity)

Image confirmation (p-plan:Activity)

prov:used

prov:used

prov:used

prov:wasGeneratedBy

[53.02,-2.11] (p-plan:Entity)

prov:wasGeneratedBy

Image (p-plan:Entity)

prov:used

[53.03,-2.12] (p-plan:Entity)

p-plan:correspondsToVariable

p-plan:correspondsToVariable

p-plan:correspondsToVariable

Retrospective Provenance

SC-PROV Concepts

- **Precondition** defines a subclass of prov:Entity representing constraints that should be satisfied before a p-plan:Step can be fulfilled.
- **Postcondition** defines a subclass of prov:Entity representing constraints that should be satisfied after the completion of a particular p-plan:Step for it to be considered successful.
- **Incentive** is a subclass of prov:Entity representing an incentive associated with the successful completion of a p-plan:Step.
- **Reward** defines a subclass of prov:Entity representing a realisation of the promised incentive (e.g. a voucher worth £1).

Future Work

In our future work we aim to develop a framework utilising the SC-PROV ontology to record the provenance of a number of social computations. The aim is to demonstrate the utility of provenance records documented using SC-PROV by evaluating the potential of such data to support reasoning about participants' trustworthiness and thus aid workforce selection.

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