Towards Provenance and Risk-Awareness in Social Computing

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Access Control in Social Computing

- Content is almost contributed by users
- Access control policies are specified by users rather than the system alone
  - Policies are expressed in terms of attributes
  - In terms of relationships in online social networks
- BUT, all of them are pre-defined static policies that always give the same outcome
  - Unfortunately, social computing environment is dynamically changing over time

Motivating Example

A user starts an **event** to discuss on the upcoming US election outcome. Anyone registered in the social network can **join** the discussion group. However, joining the group requires to **vote** on an election **poll**. In order to vote, one must demonstrate his knowledge of the candidate through an action such as to **like** the candidate's **fan page**. Furthermore, each candidate might want users to **share** their page before liking.

How to place control on the dependency of these actions?
How to place control on the occurrence and frequency of these actions?

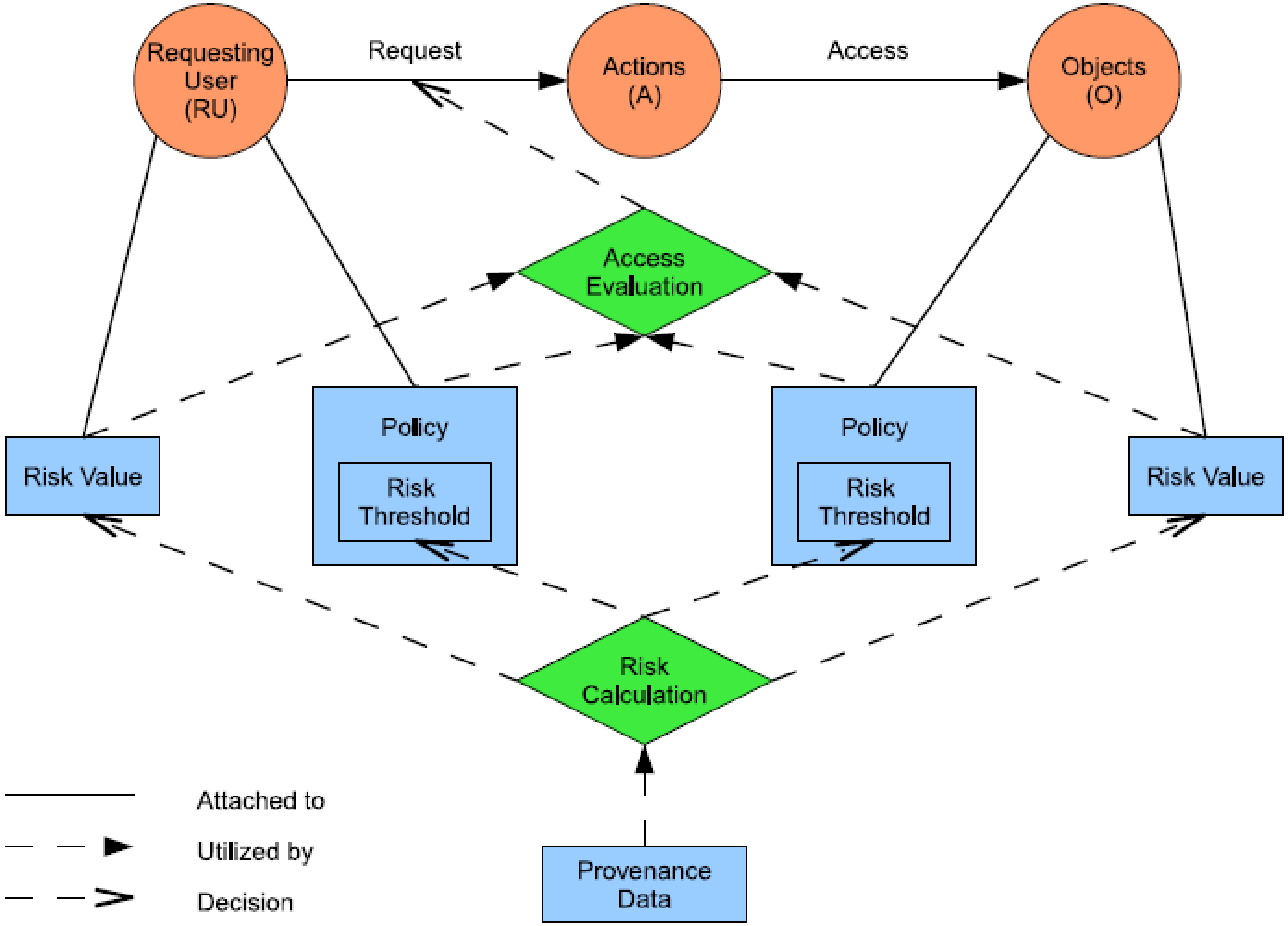
Risk-Aware Access Control

- **Risk** is *the possibility of future loss or damage*
  - Future needs and user behaviors are essentially unpredictable by static access control policies
- Risk-aware Access Control grants or denies an access dynamically based on estimated risk instead of some predefined policies
- Two key issues to assess risk:
  - Estimate the cost of permission being misused (**sensitivity**)
  - Determine the likelihood of misusing permissions (**trustworthiness**)

Provenance-Aware System

- **Provenance** of a digital data object is defined as the documentation of its origin and all the processes that influence and lead to its current state.
- In a provenance-aware system, related provenance information of system transactions/events are captured, stored, and maintained.
- Provenance potentially provides many enhanced benefits: usage tracking, workflow control, versioning, trustworthiness, repeatability, access control, etc..
- Can we use provenance for dynamic risk assessment?

Risk Aware Access Control for SC



Risk Aware Access Control for SC (cont.)

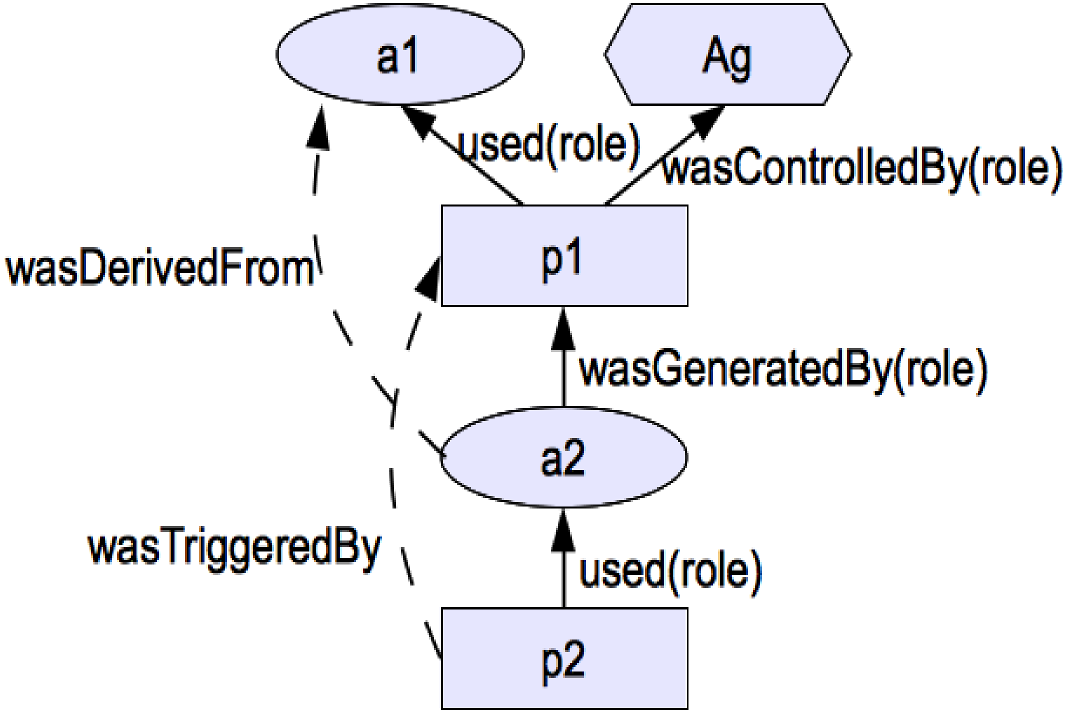
- **Risk value** represents the level of misuse granting requester access would result in
- **Risk threshold** denotes the level of sensitivity of performing the permission
- **Fluctuation of risk** serves as the basis for dynamic access control
  - User's risk value may increase or decrease as a result of her activities and behavior in the system.
  - Similarly, risk value of a resource may change depending on the past interactions on the resource.
- Requester user and resource owner can specify a risk threshold associated with each permission

Modeling Provenance Data in SC

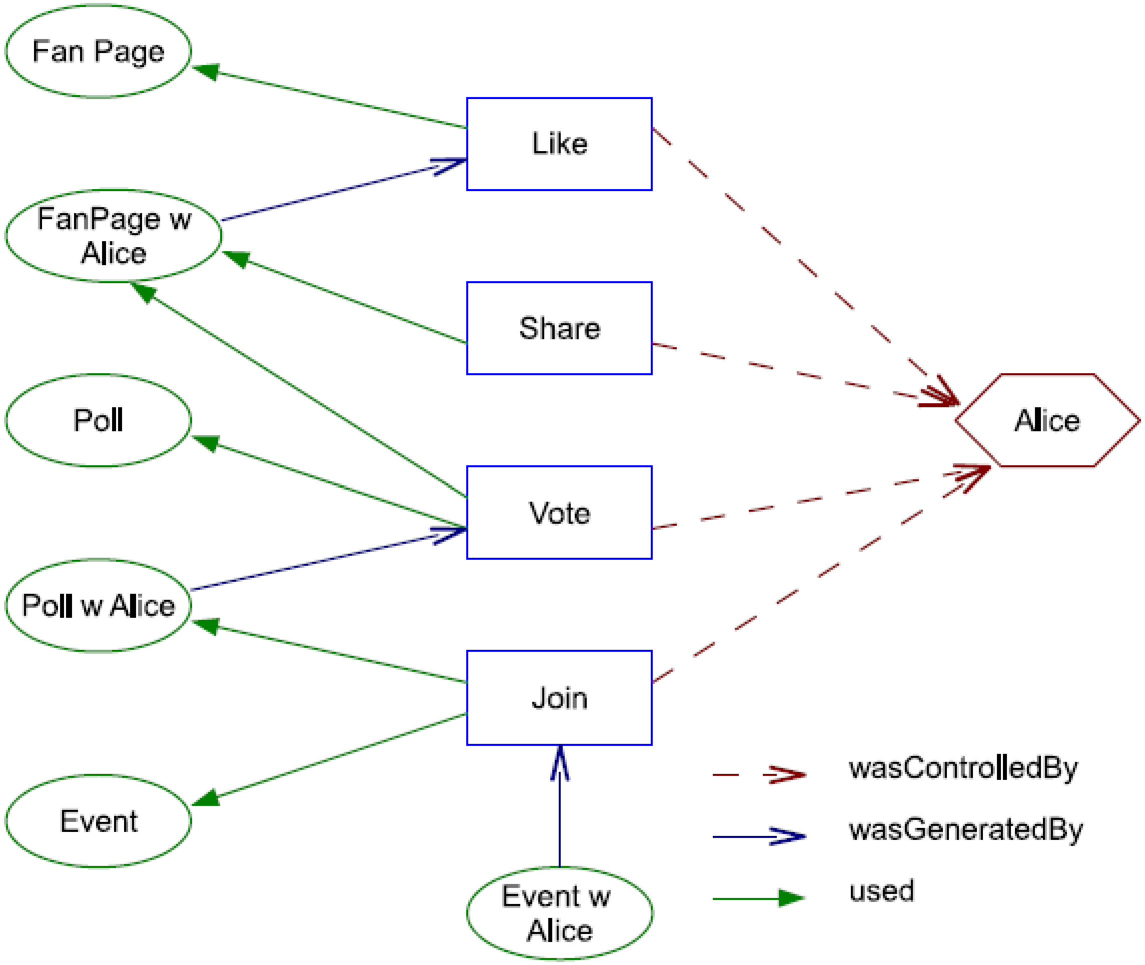
- Open Provenance Model (OPM) as the data model for provenance information
  - Captures information associated with a transaction and expresses the relations between them in causality dependencies

- 3 Nodes
  - Artifact (ellipse)
  - Process (Rectangle)
  - Agent (Octagon)

- 5 Causality dependency edges (not dataflow)



OPM Scenario



Modeling Provenance Data in SC (cont.)

- Alice requests to join an event:
  - *request(Alice, join, accountOf(Alice), event)*
- Associated transaction:
  - *(Alice, join, accountOf(Alice), event, eventWithAcountOfAliceAdded)*
- The corresponding provenance information:
  - *(join, wasControlledBy, Alice)*
  - *(join, used, event)*
  - *(join, used, accountOf(Alice))*
  - *(eventWithAccountOfAliceAdded, wasGeneratedBy, join)*

CONCLUSION

- Identify the necessity of incorporating Risk awareness and Provenance awareness in SC.
- Demonstrate through an example scenario.
- Present an approach for Provenance-based Risk Assessment.
- Present the initial effort towards a conceptual model for Risk-based Access Control.

- Questions or comments?

Thank You ☺