Social Computational Trust Model (SCTM): A Framework to Facilitate the Selection of Partners

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Context

A **Social Computational Trust Model (SCTM),** that helps **alliance** members to select the **right partner** to collaborate with and **perform collective tasks**, and encourages the **sharing of incident data and intelligence.**

Research Question

How can the **alliance members** evaluate and select the **most trustworthy** partner for a particular situation at hand while keeping the risk of **interaction at minimum?**

SCTM

❖Identify two distinctive trustworthiness factors (Benevolence and Competence)
❖Evaluate Trust in a dynamic way
❖Gather the direct and indirect evidence on a trustee
❖Update Trust value
❖Evaluate the interaction Risk
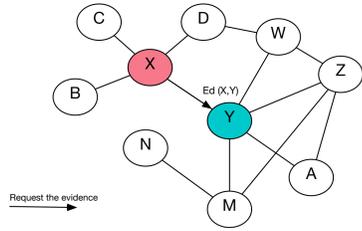
Direct and Indirect Evidence

Direct Evidence
❖A trustor looks at its Kb to collect the evidence on a trustee based on past interactions.

$$val_d(.) \longrightarrow [0,1]$$
$$Ed(x, y, s_i; kb_x) = \{d_8(x, y, s_i) \in kb_x\}$$
$$val_d(Ed(x,y,s_i; kb_x)) = \frac{1}{N_x}\sum_{d_8(x,y,s_i)\in Ed(x,y,s_i; kb_x)} val(d_8(x,y,s_i))$$
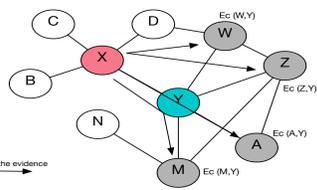
Indirect Evidence
❖A trustor asks a trustee's direct neighbors to send him their evidence on a given trustee.

$$val_c(.) \longrightarrow [0,1]$$
$$Ec(nbr_y, y, s_i) = \{ Ed(u, y, s_i; kb_u) \mid u \in nbr_y \}$$
$$val_c(Ec(x,y,s_i)) = \frac{1}{N_{nbr}}\sum_{Ed(u,y,s_i; kb_x)\in Ec(nbr_y, y, s_i)} val_d(Ed(u,y,s_i; kb_u))$$

Functions

❖ **Competence Function**
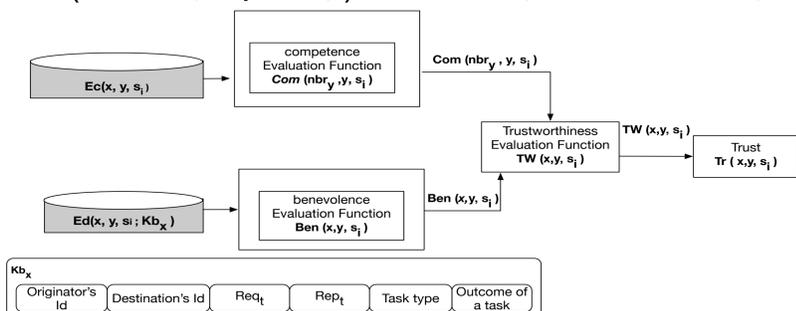$$Com(nbr_y, y, s_i) = val_c(Ec(nbr_y', y, s_i)), nbr_y' = nbr_y \setminus \{x\}$$
❖ **Benevolence Function**
$$Ben(x,y,s_i) = val_d(Ed(x,y,s_i, kb_x))$$
❖ *Interaction Risk*
$$R_i(x,y,s_i) = \alpha\left(1 - Cm(nbr_y, y, s_i)\right) + (1 - \alpha)\left(1 - Ben(x,y,s_i)\right),$$
$$0 \leq \alpha \leq 1$$

[I] Deljoo, Ameneh, et al. "Social Computational Trust Model (SCTM): A Framework to Facilitate Selection of Partners." *2018 IEEE/ACM Innovating the Network for Data-Intensive Science (INDIS)*. IEEE, 2018.

Ameneh Deljoo is a Ph.D student at University of Amsterdam. Her research interest is to discover the computational trust models to evaluate trust among the members' of an alliance. Her supervisors are prof. Cees. de Laat and Prof. Tom. van Engers (Uva).

Experiment

❖ A collaborative network implemented with BDI-Agent.
❖ Selecting a 'right' partner with the **maximum competence and benevolence** value while the **interaction risk** is **minimal.**

❖Scenario:
Domain "N" wants to choose ideal domains for collaboration in order to mitigate and defend against a certain attack.
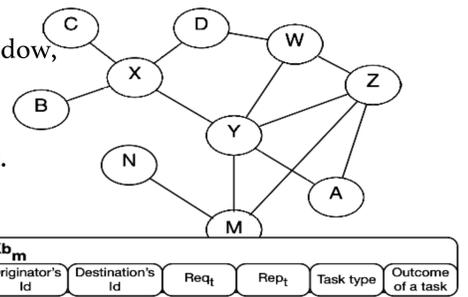
❖ **Sub-Tasks**
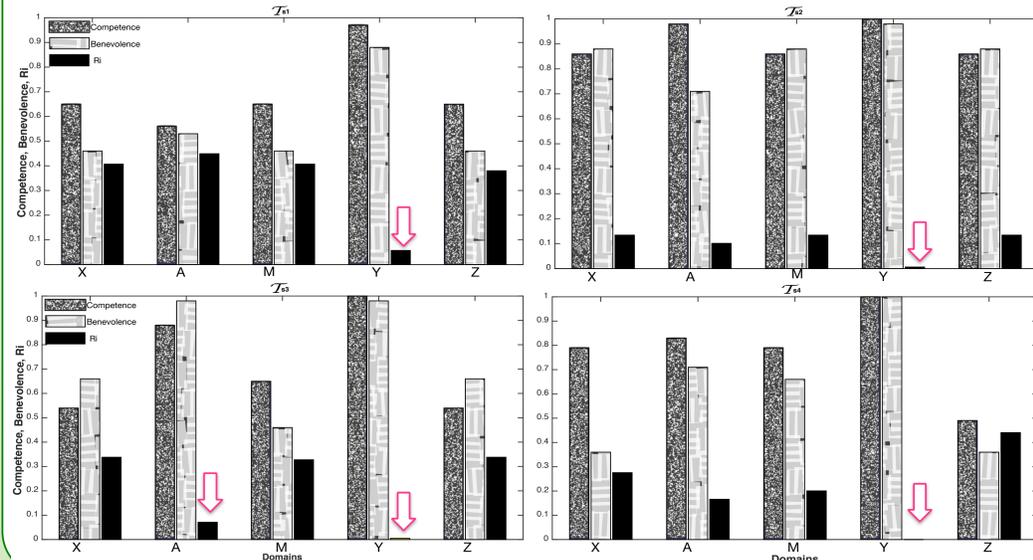τ_{s1}: provide resources within a certain time window,
τ_{s2}: monitor a certain traffic,
τ_{s3}: block a certain link,
τ_{s4}: implement a certain counter measurement.
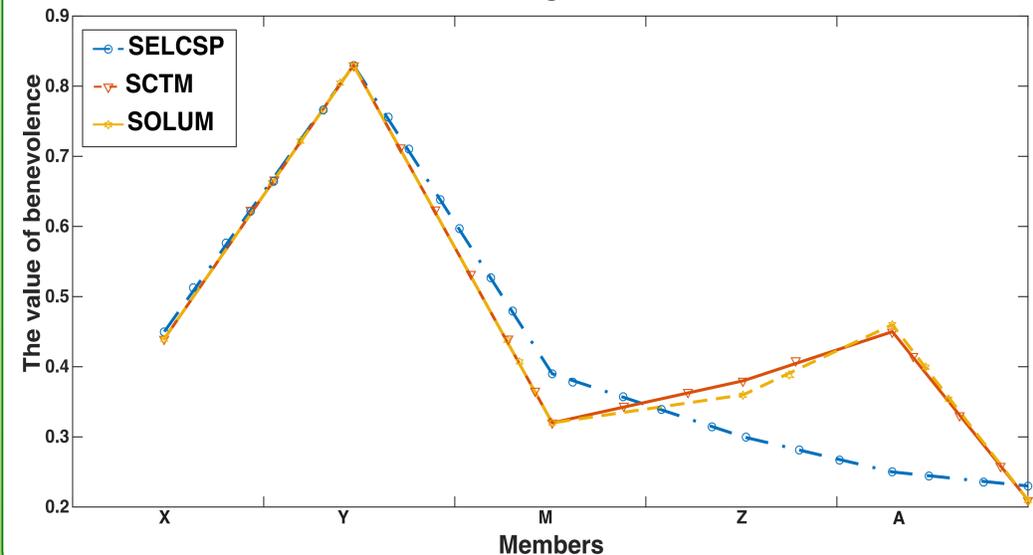

Selecting the right partner based on the competence, benevolence value and interaction risk

Evaluation of SCTM using Epinion dataset
Compare the benevolence value of SCTM with SOLUM and SELCSP algorithms

Main Results

❖The **interaction risk** estimated through the **SCTM** by combining **benevolence** and **competence.**
❖ We have shown that the **stability** of the alliance is **dependent** on the value of **benevolence** that led to a **lower interaction risk.**
❖We demonstrated that the SCTM is able to obtain **comparable results** to the other trust models that we evaluated.