Asynchronous Reputation Systems in Device-to-Device Ecosystems

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D2D ecosystems

Mobile applications able to utilise nearby devices in order to improve users' quality of experience. Whenever mobile users are willing to "ask for help" from their neighbours, they make non trivial decisions. Current motivation approaches for mobile users that participate in such environments are of two types: (i) credit-based and (ii) reputation-based. These approaches rely either on centralised authorities or require prohibitively many messages or require security modules.

Proposal

We propose a trust-based approach that does not require synchronisation between the mobile users. Moreover, we present the three-way tradeoff between, consistency, message exchange and awareness and we conclude that our approach can provide first-rate data to neighbour selection mechanisms for D2D ecosystems with much less overhead.

Credits vs Reputation

Credit based schemes stimulate user cooperation in terms of resource sharing by means of credits. The idea is that users providing a service should be remunerated, while users receiving a service should be charged.

Reputation based schemes discourage misbehaviour by estimating users reputation and punishing the ones with bad behaviour.

How to gain asynchronicity

- Trust is a **subjective** concept since it is based on data collected by the mobile user that produces trust scores as well as from data she received by other trusted mobile users.
- This **subjectiveness implies a flexibility in the amount of the required message exchange and also determines the amount of inconsistency**.
- Credit based systems require full consistency, otherwise any malicious user can cheat and make the system collapse.
- We do not force users to exchange messages after any interaction but we allow them to ask for recommendations.
- The frequency with which a mobile user is updating her knowledge base for other mobile users defines her **awareness**.
- Awareness differs from consistency on the fact that it does not require full knowledge about everything but only enough information to produce a **robust** trust score.

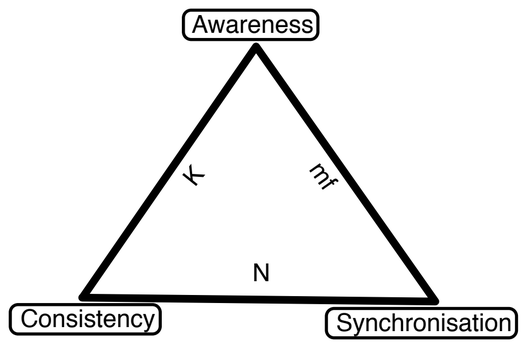

Figure 1: Three way tradeoff of trust estimation in D2D ecosystems.

D2D application examples

- P2P based k-anonymity location privacy
- Cooperative Streaming
- Face Recognition
- Video Compression
- Sensing
- Computation offloading
- Opportunistic Networking

Evaluation

Figure 2 shows how many retransmissions are required in order for one message to arrive to all the users of the network in the case of 1000 users or 2000 users. Figure 3 shows how the graph diameter is decreasing and the fraction of the users in the major connected component is converging to 100% when the connectivity threshold is increasing.

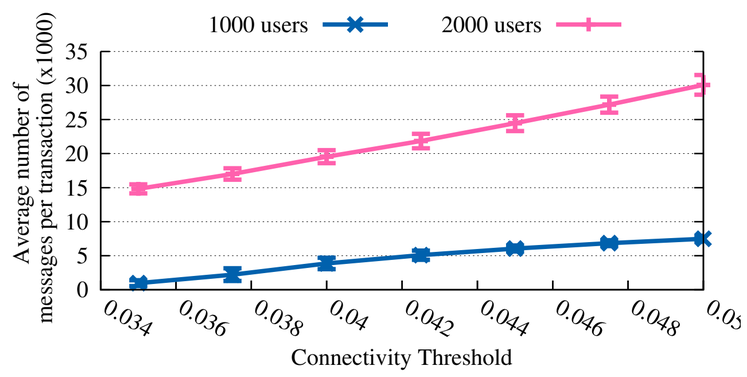

Figure 2: Transmitted messages per transaction

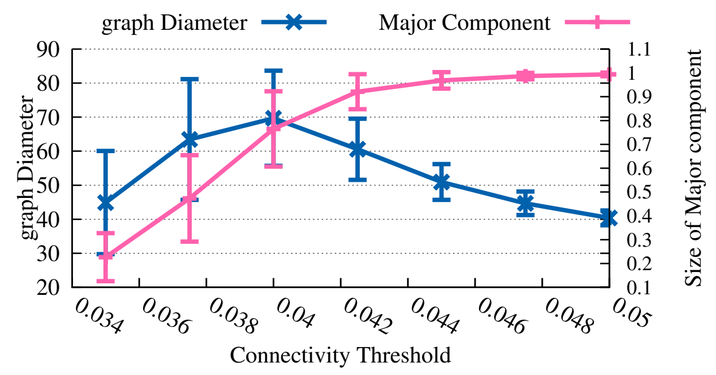

Figure 3: Graph diameter and size of the major connected component

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