Nomination

2016 Caspar Bowden PET Award

The following information is required for the nomination.

Paper title

Evaluating Location Privacy in Vehicular Communications and Applications

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A nomination statement of no more than 500 words.

Please consider the nominated paper, *Evaluating Location Privacy in Vehicular Communications and Applications*, for the 2016 Caspar Bowden Award for Outstanding Research in Privacy Enhancing Technologies. The paper makes an outstanding contribution to the theory of privacy enhancing technology, and has already been recognized by other top technology, security and privacy researchers.

- The paper offers novel solutions to fundamental privacy problems, most notably how to define location privacy, and how to measure location privacy. The paper's contributions are not limited to vehicular contexts.
- The paper considers Internet of Things (IoT) concerns, such as measuring location privacy of ubiquitous network-connected entities in motion at high speeds. The paper addresses privacy issues in the most current and emerging network contexts.
- The lead author was invited to present the paper at 2016 IEEE End to End Trust and Security Workshop for the Internet of Things in Washington, DC. The paper is of interest to national policy makers and technologists.
- The paper has been published in a special issue of one of the most prestigious, high-impact-factor journals in the field, IEEE Transactions on Intelligent Transportation Systems. The paper exhibits a high level of intellectual rigor and broad significance.

Specific contributions: The paper (1) defines continuous network location privacy, (2) presents KDT-anonymity, a composite metric including average anonymity set size, K, average distance deviation, D, and anonymity duration, T, (3) derives formulas to calculate theoretical values of K, D and T, (4) evaluates five privacy protocols under realistic vehicle mobility patterns using KDT-anonymity, and (5) compares KDT-anonymity with prior metrics.

Defining location privacy in a pervasively networked world is no small feat. There is no consensus among researchers, let alone lay people, on a formal definition. The authors offer the following, which is comprehensible to lay people and rigorous enough to be used to create metrics.

> Continuous Network Location Privacy: The degree to which, over a contiguous series of time intervals, a spatial characteristic of an entity cannot be linked to its identity while it is connected to a communications system.

Measuring location privacy may be even more challenging than defining it. There is some consensus on how to measure identity privacy (k-anonymity), but few researchers have considered distance or time of anonymity in networks involving frequent communications containing precise location data. If two entities' identities are indistinguishable, and they are in very close proximity, to what degree can they be said to possess the property of location privacy? Similarly, if entities maintain anonymity for only a short time, of what use is such location privacy?

The authors offer metrics to measure not only identity privacy (anonymity) in a continuous network, but also distance privacy and time privacy. Such metrics have never before been formalized. Coupled with definitions, formulas and evaluations of simulations, these metrics represent an unusually significant advancement in the field of digital privacy. Consequently, we hope the paper will be deemed worthy of the 2016 Caspar Bowden PET Award.