Approaching Privacy in ITS

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Overview

- Background
- Emerging Issues
- Current Practice
- Recent Approaches
- Next Steps

Approaches to Traffic Forecasting/Modeling

- Static:
  - Travel surveys (on-boards and household)
  - Historical data
- Dynamic:
  - GPS
  - Road sensors (inductive loop detectors, etc.)

Emerging Method

- Combined Static/Dynamic approach:
  - More consistent and accurate trip reporting;
  - More accurate reporting of non-auto trips;
  - Data gathered on specific routes; and
  - Ability to compare real-time data to historic data to ensure reliability.

Emerging Privacy Issues

- Though privacy may be maintained at the individual levels (survey or GPS) in the combined approach, this does not ensure that combined data will maintain expected levels of confidentiality.
- With additional data mining and data linkages (ex. Census), it may be possible to more clearly identify individual travelers or households.

Current Practices in Privacy Protection

- Census: Title 13
  - Requires that “any information collected from the public under the authority of Title 13 be maintained as confidential”
    - Suppression
    - Data swapping
    - Protection of microdata files

Current Practices in Privacy Protection (cont.)

- ITSA Fair Information and Privacy Principles
  - Advisory policy adopted in 2001
  - Some key requirements:
    - Individual Centered
    - Relevant
    - Anonymity
    - Commercial or other secondary use

Some Recent Approaches to Addressing Privacy in ITS

- Traffic monitoring with probe vehicles (Hoh, et al.):
  - Issue:
    - Maintain both data integrity and privacy
  - Proposed solution:
    - Architecture assigns authentication of data and filtering to one entity and actual data analysis to a separate entity.
  - Remaining issues:
    - Depending upon the frequency of probe updates, a clustering analysis may still allow an individual's home or other destination location to be determined.

Some Recent Approaches to Addressing Privacy in ITS

- Privacy Issues in Vehicular Ad Hoc Networks (Dötzer):
  - Issue:
    - Is identification necessary in VANETS, or only a guarantee that the sender is valid/trustworthy?
  - Proposed solution:
    - Utilize a trusted third party to store identities and map one or more pseudonyms and related credentials to each identity. When sending messages, the vehicle will send a pseudonym and credentials to be verified by the receiving entity.
  - Remaining issues:
    - How often would pseudonyms need to be changed to maintain privacy?
    - What are the data use restrictions on the trusted third party?

Some Recent Approaches to Addressing Privacy in ITS

- Adaptive privacy preserving authentication in vehicular networks (Sha, et al.):
  - Issue:
    - How can the level of privacy desired be specified by the user?
  - Proposed solution:
    - Utilization of an adaptive group-based protocol that is able to trade off the degree of privacy desired with necessary resource usage.
  - Remaining issues:
    - Accurately identifying the group size needed to ensure privacy.
    - Maintaining a reasonable balance between privacy and resource usage.

However…

- The methods explored above focus their efforts primarily on maintaining privacy within the mobile network.
- This still leaves the need to ensure that data archives will maintain privacy standards, even when linked with data from travel surveys or the Census.

Next Steps for Future Research

- Work towards developing methods for ensuring that privacy is maintained when linking data sources through a combined approach to travel modeling and forecasting.
- Work towards establishing a data model that addresses privacy needs at the user, technology, and policy/political levels.

"If ITS systems are developed and deployed which do not respect the privacy of the American driver, there is a good chance that Americans will demand that the system be shut off. Without strong privacy provisions, ITS will not succeed."

– S. Garfinkel. "Why driver privacy must be a part of ITS." 1996.