## Goals

- To show that the cyber security protection of the *V2G* communication layer can be cast into a form so that the *Least Privilege Architecture (LPA)* provides an appropriate structure to protect the cyber security of the grid.

- To adapt *LPA* to the specific needs of the *V2G* problem.

- To demonstrate the ability of the adapted *LPA* to operate effectively in the *V2G* framework.

V2G COMMUNICATION/CONTROL LAYER
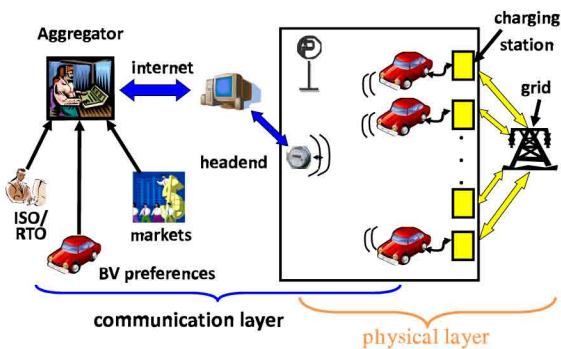

Fundamental Questions/Challenges

- Consumer acceptance.
- Interface for consumer preferences.
- Training for changing consumer behavior.
- Credible cyber security threats.
- Latency in the communication system.
- Measurement frequency for data integrity.
- Scalability and performance of the *LPA* in a large-scale *V2G* aggregation.

Research Plan

- Investigate the requirements for *V2G*.
- Adoption of *LPA* for *V2G*.
- Specification of privileges for each entity:
  - the *Aggregator*.
  - the individual *BV*s.
  - third parties.
- Preparation of a final report.

Research Results

- *LPA* provides mechanisms to effectively limit the privileges of each service so that it can only access the functions it needs to fully complete its tasks.

- *LPA* provides restricted access to the database to each service at a level commensurate with the requirements to complete the service tasks.

- *LPA* facilitates the decomposition of the *Aggregator*'s functions into logically disjoint services, leading to enhanced security.

- *LPA* minimizes the impact of a successful attack on a single service.

- *LPA* allows room to expand services to third-party vendors.

- *LPA* facilitates the easy expansion of the number of *BV*s and parking lots in the aggregation.
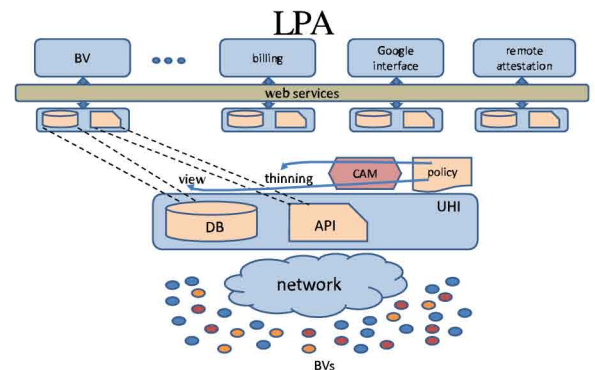
Broader Impact

- The *V2G* communication layer requires extensive bi-directional communication and therefore is vulnerable to cyber attacks.

- The lack of adequate security measures is a major impediment to the effective integration of battery vehicles (*BV*s) into the grid.

Interaction with Other Projects

- "Security Architectures for Smart Grid Headend Systems," Carl A. Gunter and George Gross, University of Illinois

- Eileen Denz, LM – EIG – ECS, Project Manager