V2G Cyber Security

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Background

- The Vehicle-to-grid (V2G) concept integrates Battery Vehicles (BVs) into the grid as controllable loads and generation/storage devices
- An Aggregator is needed to control the BVs and to provide services to the grid economically
- A communication network is required to control the BVs
- This communication network requires extensive bi-directional communication and therefore becomes subject to cyber attacks on the grid

V2G Communication/Control Layer

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

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 Tasks

- Investigate the requirements for V2G
- Adoption of LPA for V2G
- Specification of privileges for each entity:
  - the Aggregator
  - the individual BVs
  - 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 BVs and parking lots in the aggregation

Related Work/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