Privacy-preserving Data Sharing in Smart Grid Systems

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The smart grid systems aim to integrate conventional power grids with modern information communication technology. While intensive research efforts have been focused on ensuring data correctness in AMI data collection and protecting data confidentiality in smart grid communications, less effort has been devoted to privacy protection in smart grid data management and sharing. In smart grid data management, the Advanced Metering Infrastructure (AMI) collects high-frequency energy consumption data, which often contains rich inhabitant and lifestyle information about the end consumers. The data is often shared with various stakeholders, such as the generators, distributors and marketers. However, the utility may not have consent of the users to share potentially sensitive data. In this paper, we develop comprehensive mechanisms to enable privacy-preserving smart data management. First, we analyze the privacy threats issues associated with high-frequency AMI data. We then present the first solution based on data sanitization, which eliminates sensitive information before sharing usage data with external peers. Meanwhile, we present solutions based on secure multi-party computing to enable external peers to perform aggregate/statistical operations on original metering data in a privacy-preserving manner. Experiments on real-world consumption data demonstrate the validity and effectiveness of the proposed solutions.