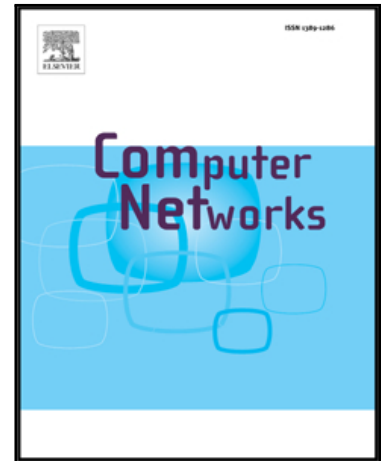


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VerSAMI: Versatile and Scalable key management for Smart Grid AMI systems

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Abstract

In this paper, we propose four new key management schemes for Advanced Metering Infrastructure (AMI) to secure data communications in the Smart Grid (SG). The schemes are based on individual and batch rekeying operations using a novel multi-group key graph structure, are also versatile in the sense that they can support broadcast, unicast, as well as multicast communications. Security analysis shows that our schemes satisfy key management security properties. Furthermore, performance analysis and simulation results demonstrate that our schemes can scale to large AMI systems, and they incur low cost in terms of storage, communication overheads and time of key distribution compared to state-of-the-art schemes.

Keywords: Smart Grid, Advanced Metering Infrastructure, Cyber Security, Key Management Scheme, Individual rekeying, Batch rekeying.

1. Introduction

The Smart Grid (SG), also called intelligent grid, intelligrid or futuregrid [2], refers to a modernization of electric grid that incorporates information, advanced two-way communication and computational intelligence to the electricity generation, distribution and management, in order to improve control, efficiency, agility, economy, reliability, security and safety [2–4]. The smart grid provides many benefits such as: (1) the greater availability of electricity to homes at a lower cost, (2) the incorporation of renewable power generation such as wind and solar power into the grid, and (3) the improvement of the grid security and self-healing [5]. A succession of sub-systems should be realized in order to achieve an efficient, intelligent and sustainable grid [6]: Advanced Metering Infrastructure (AMI), Advanced Distribution Operations (ADO), Advanced Transmission Operations (ATO) and Advanced Asset Management (AAM).

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