A SCALABLE EXTENSION OF GROUP KEY MANAGEMENT PROTOCOL *

R. Poovendran, S. Ahmed, S. Corson, J. Baras
Institute for System Research
University of Maryland
College Park, MD 20472

ABSTRACT

This paper presents a robust, scalable extension to the recently proposed multicast Group Key Management Protocol (GKMP) ([1], [2]), in terms of security administration. The GKMP has two major security related problems: (a) lack of any mechanism to remove a compromised group administrator, (b) lack of scalability. We are able to remove a compromised single panel member from generating the group keys by setting the panel members with shared authority to generate the group keys. We then introduce the sub-controllers who have all the functionalities of the group control panel except the authority to generate the group keys. The sub-control panel helps scalability of the network in terms of the security operations. The sub-controllers are chosen using a threshold based clustering algorithm.

INTRODUCTION

Many military and Internet applications are based on multicast communication. These applications often need privacy and protection from intruders. In order to enforce the privacy and protection, these applications require cryptographic key usage for secure admission of new members and secure communication among existing members. The issue of exchanging the relevant keys in a multicast environment is an active area of research.

Apart from the secure joining and information exchange, there are other administrative duties related to security and communication that a group should provide. For example modality of the members is an issue in some multicast groups. In a highly dynamic group, members may decide to leave the group and rejoin at a later time. It is also possible that late arriving members get access to the previous data of the session in progress

Depending on the anticipated size and nature of the group, it may be possible to establish some mechanism to control the security and other administrative duties of the group. In a military environment, it is possible that a high command authority provides the necessary key to the selected members who will establish the group. This may be done in person in a one-on-one manner. Though this method is possibly secure, it is rather inefficient.

Another way to establish a secure group is to have a dedicated Key Distribution Center (KDC) to generate and issue high quality keys (symmetric). Everyone who wants to join a particular group will have to request an appropriate key from the KDC. After verification of the member's credentials, the KDC will issue the necessary symmetric key encrypted using the session key between the KDC and the member. This mechanism has the following advantage: if the group key is compromised, KDC can individually contact the members and rekey the group. However, this method has the following disadvantages: (a) regardless of the size of the group, every new member has to join via the KDC, (b) every time the key is updated, the KDC should be able to access all the members, (c) if the number of groups is large, which would be the case in the Internet, the KDC would be heavily over loaded, (d) if the KDC is compromised, then the credentials of all the groups will be accessible by the intruder.

The GKMP [1] allows a designated group member called the *group controller* to generate and distribute the keys for privacy and security. In doing so, the KDC is effectively replaced by another security entity (entities) which operates at the group level. Any node of the network can be a group controller as long as it is certified to do so by a Security Manager (SM). This approach essentially creates *virtual KDC* for each group.

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