Kerberos Security Model for SNMPv3

Rajaram Pejaver
Yiu Lee
Wes Hardaker
Ken Hornstein

November 2010

Outline

- ❑ Introduction: Kerberos Security Model for SNMPv3
- ❑ Why we need a new security model
- ❑ Use cases driving this proposal
- ❑ New requirements for security model
- ❑ Proposed security model
- ❑ Elements of Procedure
- ❑ Next steps

Introduction

- About the authors

Rajaram Pejaver	Comcast Cable
Yiu L. Lee	Comcast Cable
Wes Hardaker	SPARTA, Inc.
Ken Hornstein	US Naval Research Laboratory

- Previous Submission: draft-hornstein-snmpv3-ksm-00
  - Ken Hornstein & Wes Hardaker, June 25, 1999.

Use cases driving this proposal

❑ Untrusted Managed Devices

- ➢ Examples: Modems, Set Top Boxes, Home Routers.
- ➢ They can tampered with because they are physically located in customer's homes.
  - ✓ It may be possible for an attacker to replace and spoof one of these devices.
- ➢ Any globally sensitive data sent to them may be compromised.
  - ✓ Example: SNMP administrator' s SSH's username and password.

❑ Low end Managed Devices

- ➢ Examples: Modems, Set Top Boxes, Home Routers.
- ➢ They may not have the math processing capabilities to do PK operations quickly.
- ➢ They may not be able to maintain session state due to memory limitations.

❑ Large numbers of Managed Devices

- ➢ Examples: there are millions such devices deployed in North America.
- ➢ Devices will be periodically queried to retrieve device health & traffic load values.
- ➢ Automated Managers will poll multiple devices per second.
- ➢ Human administrators will access multiple devices while troubleshooting.

USM and RADIUS Models

- ❑ USM has its own local table of users.
- ❑ RFC5592 + RFC5608 requires:
  - ➢ Use SSH to establish a secure session between Network Management Application to the SNMP Engine/RADIUS Client.
  - ➢ SSH may outsource the validation of a user’s password via a local RADIUS client to a RADIUS server.
  - ➢ Upon successful authentication, SNMP stack may receive the *groupName*.
  - ➢ This model requires the Network Management Application and SNMP Engine to form a SSH session.

Kerberos Security Model Supports

KSM for SNMPv3

❑ Centralized Security Administration.

- ➢ For authentication of Kerberos users (device administrators)
  - ✓ Authentication is handled without interaction with the managed device
- ➢ For authorization of SNMP users (device administrators)
  - ✓ Addressed the same way as the I-D.ietf-isms-radius-vacm draft

❑ Strong Authentication (using two factor mechanisms.)

- ➢ Enterprises typically require this for accessing sensitive Managed Devices.
- ➢ Hardware security tokens sometimes require additional interactions with the user.
  - ✓ Not explicitly addressed by RFC5608, but could be extended.

❑ Convenience

- ➢ Each subsequent device does not require user re-authentication.

❑ Efficiency

- ➢ Does not require Managed Devices to save state between SNMP requests.
- ➢ Does not require Managed Devices to perform excessive computations.
- ➢ Minimizes the setup overhead before sending request.

Proposed security model: KSM

❑ Architectural placement of KSM

- ➢ This model is a peer to USM in the SNMP architecture.
- ➢ It uses VACM, and does not require any modifications to it.
- ➢ It uses VACM just like I-D.ietf-isms-radius-vacm does.
- ➢ It does not use or rely on any transport models.

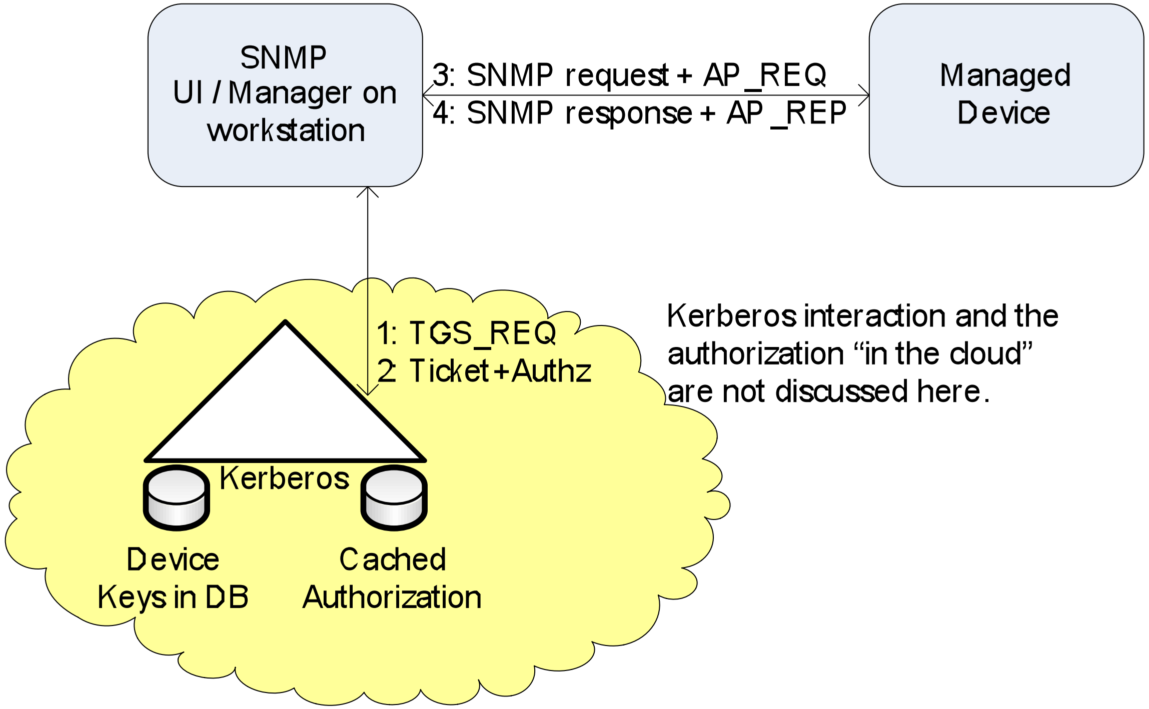
❑ Dependencies

- ➢ This model requires a Kerberos KDC server.
- ➢ It uses an Authorization Database for centralized authorization mappings.
  - ✓ Specifically, it maps securityName ➔ groupName.
  - ✓ For example:
    - ▪ Jack ➔ ConfigurationMgr; Jill ➔ Auditor; Joe ➔ Assistant;
    - ▪ Jack gets write access; Jill gets read access; Joe gets nothing.
  - ✓ The groupName may also be thought of as a role, permissions, …
  - ✓ This value of groupName must be recognized by the Command Responder.
- ➢ The KDC and Authorization Database will not be discussed here.

Proposed security model: KSM (cont)

❑ SNMPv3 Headers:

- ➢ *securityModel* must contain a new value indicating KSM.
- ➢ *securityParameters* must contain `ksmSecurityParameters`.
  - ✓ `ksmSecurityParameters` must contain Kerberos AP_REQ or AP_REP.
- ➢ *securityLevel* must contain *noAuthNoPriv, authNoPriv, or authPriv.*



Kerberos interaction and the authorization “in the cloud” are not discussed here.

IETF 79: Beijing, China, November 10, 2010

Proposed security model: KSM (cont)

❑ ksmSecurityParameters

```
ksmSecurityParameters ::= SEQUENCE {
   -- The Kerberos 5 checksum type used to checksum this message
   ksmChecksumType  INTEGER(0..2147483647),
   -- The actual keyed checksum data returned by Kerberos
   ksmChecksum      OCTET STRING,
   -- The Kerberos 5 message (AP_REQ or AP_REP)
   ksmKerberosMsg   OCTET STRING
}
```

- ➢ Message is encrypted when the securityLevel is *authPriv*
  - ✓ *scopedPDU* is encrypted, resulting in a KRB_PRIV message.
- ➢ All messages are Integrity protected, except for *noAuthNoPriv messages*.
  - ✓ The entire message, including the SNMPv3 header, is protected.
  - ✓ Kerberos ‘checksums’ are actually keyed hashes, described in RFC 3961.

❑ KSM notes

- ➢ Timeliness & replay detection are addressed by KRB_PRIV methods.
- ➢ securityNames for users and devices must be Kerberos Principal names.
  - ✓ Example: joe@example.com
- ➢ Each request and response must carry a Kerberos message (AP_REQ/P).

Elements of Procedure

❑ Procedure for Outgoing Requests

- ➢ Command Generator contacts the KDC server to retrieve the Kerberos ticket. The ticket contains the *groupName* and *securityName*.
- ➢ Command Generator hashes the SNMP’s PDU and creates the *ksmChecksum*.
- ➢ Command Generator creates the *ksmSecurityParameters* and sends the request to the Command Responder.

❑ Procedure for Incoming Requests

- ➢ Command Responder extracts the kerberos ticket, decrypts the PDU and extracts the *groupName* and *securityName* from the ticket.
- ➢ Command Responder creates an entry in *vacmSecurityToGroupTable*:
  - ✓ *vacmSecurityModel* is *KSM*
  - ✓ *vacmSecurityName is the extracted principle and realm (joe@example.com)*
  - ✓ *vacmGroupName* is *the extracted value*
  - ✓ *vacmSecurityToGroupStorageType* is “volatile”
  - ✓ *vacmSecurityToGroupStatus* is “active”

Next steps

- ❑ Status
  - ➢ draft-pejaver-isms-kerberos-01 was published.
    - ✓ It needs more work.
  - ➢ Issues are open for discussion.
- ❑ Demo of sample implementation.
- ❑ Adopt KSM as a ISMS Working Group item

❑Discussion