Group Key Management using IKEv2

draft-yeung-g-ikev2-16

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IETF 105

IP Multicast Security in the IETF

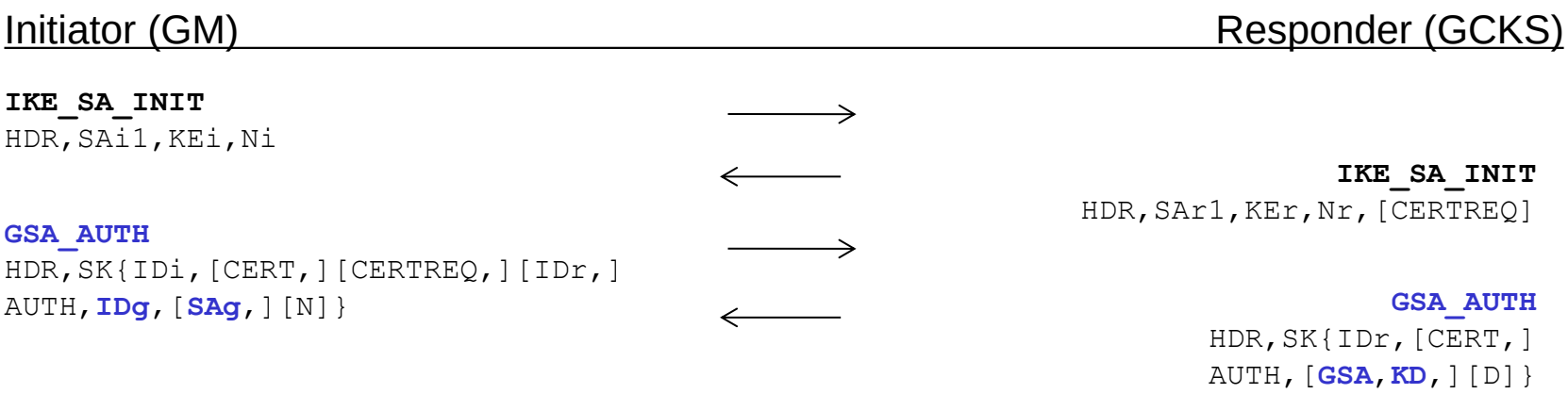
- The Multicast Security (MSEC) WG was active in 2001-2011, which looked at the needs of securing IP multicast traffic
  - RFC 3740: The Multicast Group Security Architecture
  - RFC 4046: MSEC Group Key Management Architecture
  - RFC 5374: Multicast Extensions to the Security Architecture for the Internet Protocol
  - RFC 6407: The Group Domain of Interpretation
- Platforms supporting IP multicast security take advantage of IKEv2 benefits by replacing GDOI with G-IKEv2

Securing IP Multicast

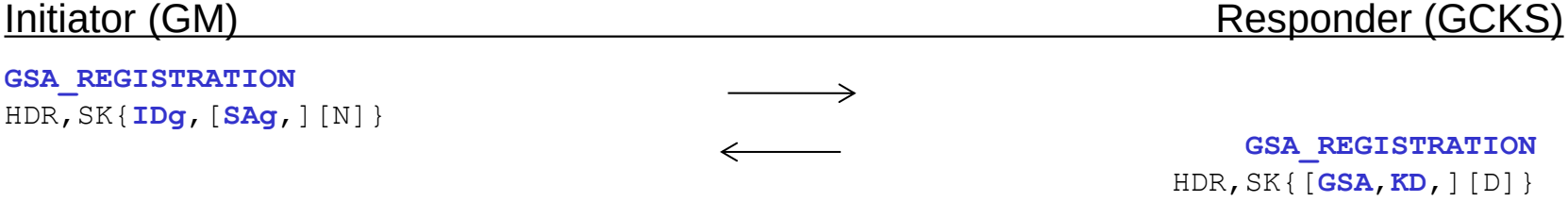
- IP multicast applications
  - Contain at least 1 sender, and N receivers
  - Take advantage of the network to route and replicate IP packets, such that the same packet reaches all N receivers
- This requires senders and receivers to share setup an IPsec SA using the same keys
  - The IPsec policy and keys are not individually negotiated, but instead of distributed by a Group Controller / Key Server (GCKS) to Group Members (GMs)
  - A GM invokes a unicast Registration protocol to authenticate to the GCKS. The GCKS then authorizes the GM, and distributes IPsec policy and keys to the GM.
  - A Rekey protocol enforces a time-based key rollover strategy

G-IKEv2 Registration

- Initial registration (no IKE SA between GM and GCKS)

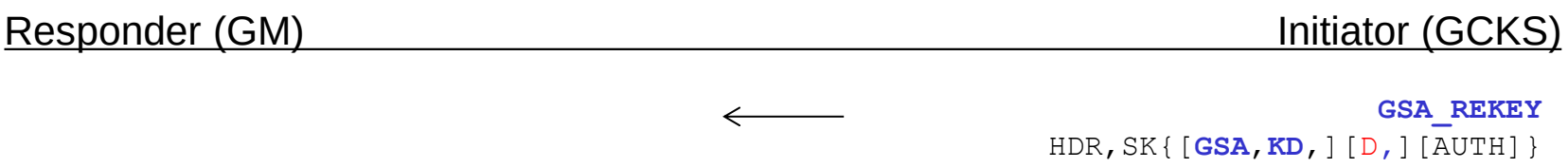


- Subsequent registration (IKE SA has already been created)

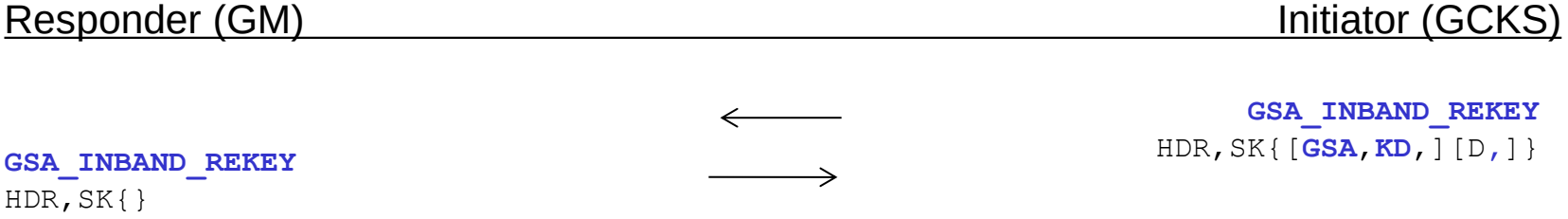


G-IKEv2 Rekey

- Multicast rekey: intended for large groups, protected by policy previously distributed by the GCKS



- Unicast rekey: intended for small groups, used registration IKE SAs with each GM



GSA Payload

Contains policy necessary to participating in the group:

- Traffic Encryption Key (TEK) policy
  - AH/ESP SPI, traffic selectors, single set of AH/ESP SA related transforms, additional attributes
- Key Encrypting Key (KEK) policy
  - Rekey SA SPI, traffic selectors, single set of IKE SA related transforms, additional attributes
- Group Associated Policy (GAP) (other group-wide policy)
  - SA Activation time, SA deactivation time

KD Payload

Contains keying material necessary for the policy in the GSA payload

- TEK
  - AH/ESP SPI, keying material
- KEK
  - Rekey SA SPI, keying material
- LKH
  - Logical Key Hierarchy key arrays
- SID
  - Sender-ID (SID) values for a GM acting as a sender

IDg Payload

Contains identity of the group a GM wants to join

- has the same format as IKEv2 ID payload
- only some ID types are expected to be used
  - ID_KEY_ID **MUST** be supported
  - ID_IPV4_ADDR, ID_IPV6_ADDR, ID_FQDN, ID_RFC822_ADDR **SHOULD** be supported

Reuse of IKEv2 payloads

Payloads that have the same types as in IKEv2, but slightly different semantics

- SAg (GM Supported Transforms)
  - has the same format as IKEv2 SA payload
  - declares which Transforms a GM is willing to accept
- D (Delete Payload)
  - used when the GCKS may want to signal to group members to delete policy (e.g., data flows finished, change of policy)

New Notifications

- INVALID_GROUP_ID (error notify)
  - GCKS informs GM that the requested Group ID in a registration protocol is invalid
- AUTHORIZATION_FAILED (error notify)
  - GCKS informs GM that it is not authorized to join the requested Group ID
- REGISTRATION_FAILED (error notify)
  - GCKS informs GM that for some reason the GM cannot join the group
  - GM sends to GCKS to unregister from the group
- SENDER (status notify)
  - GM informs the GCKS about its intention to be a sender in the group
  - requests a number of Sender-ID values, that are used as part of a counter-mode transform nonce (RFC 6054)

Draft Maturity & Implementations

- The draft has been in development for several years
  - last version of the draft received quite a lot of changes
- Implementations
  - One known full implementation (older version of the draft)
  - A couple of known partial implementations, including the “Minimal G-IKEv2” work presented at IETF 99
  - Initial Interop results (Ludwig-Maximilians-Universität München & Cisco): http://mnm-team.org/pub/Fopras/enge18/PDFVersion/enge18.pdf

Thank you!

- Comments?
- Questions?
- Document adoption?