Privacy Addition to the IKEv2 IKE_SA_INIT Exchange

draft-dschinazi-ipsecme-sa-init-privacy-addition-00

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Problem Statement: Privacy

- IKEv2 is robust and secure after AUTH check
- Some information is leaked before then
  - Initiator identity
  - Fact that IKEv2 responder is running
- Important: this discusses an addition that does NOT replace any existing IKEv2 security mechanisms

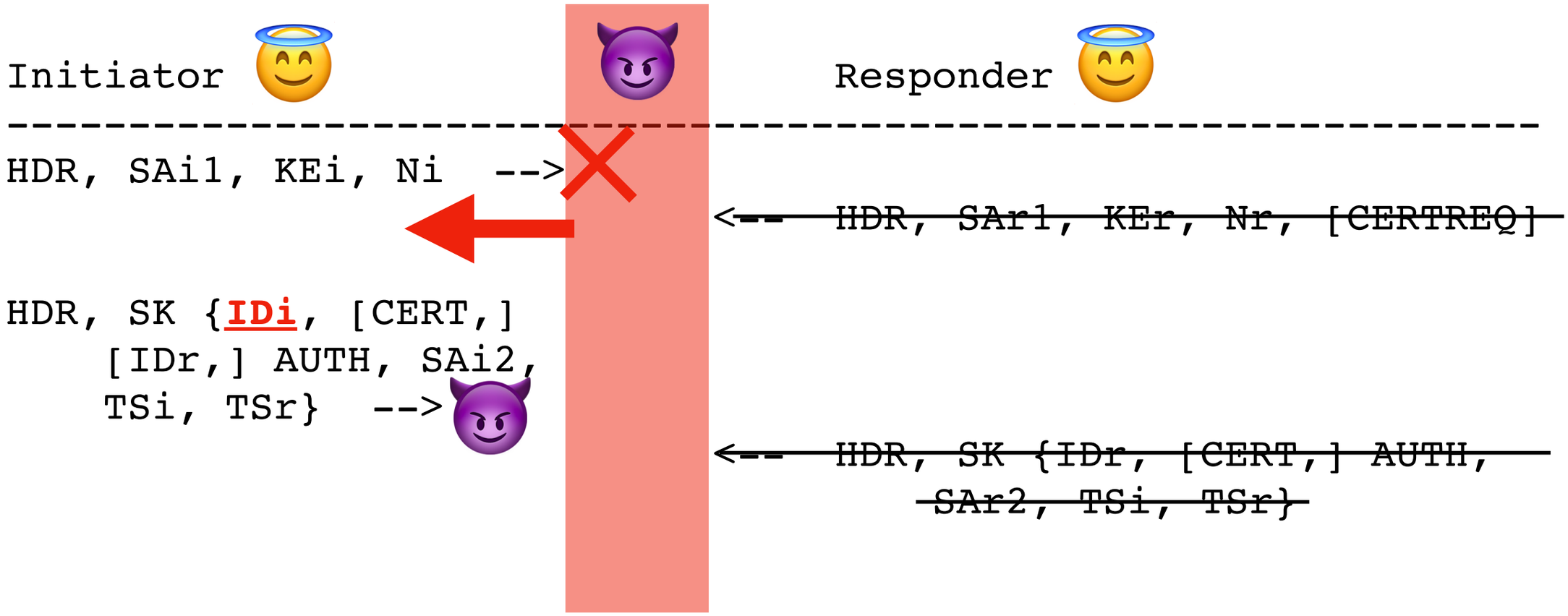
Case 1: Initiator Identity

```
Initiator                                   Responder
-------------------------------------------------------------------
HDR, SAi1, KEi, Ni  -->
                                    <--  HDR, SAr1, KEr, Nr, [CERTREQ]

HDR, SK {IDi, [CERT,] [CERTREQ,]
    [IDr,] AUTH, SAi2,
    TSi, TSr}  -->
                                    <--  HDR, SK {IDr, [CERT,] AUTH,
                                             SAr2, TSi, TSr}
```

- Initiator Identity (IDi) sent before responder has been authenticated
- Leaked to on-path active attacker

Case 1: Initiator Identity



- Initiator Identity (IDi) sent before responder has been authenticated
- Leaked to on-path active attacker

Case 2: Hidden Server

- Some users wish to hide the fact that they use a VPN
- Solution: IKEv2 over TLS/TCP/443 — RFC 8229
- Evil operator can observe traffic to server and probe for IKEv2 support by sending IKE_SA_INIT

Proposed Solution: Initialization Authentication Code

- Add to configuration:
  - Shared secret (IAC)
  - Pseudo-random function (prf)
- Added optional notify on IKE_SA_INIT messages

Proposed Solution: Initialization Authentication Code

- Initiator sends IAC_i with IKE_SA_INIT request
- Responder verifies IAC_i and drops silently if fail
- Responder sends IAC_r with IKE_SA_INIT reply
- Initiator verifies IAC_r and fails exchange if fail

Proposed Solution: Initialization Authentication Code

- Computed as follows:

```
IAC_i = prf_i( prf_i(IASS_i, "Initialization Authentication Key Pad
                      for IKEv2 Initiator"),
               Ni)

IAC_r = prf_r( prf_r(IASS_r, "Initialization Authentication Key Pad
                      for IKEv2 Responder"),
               Ni | Nr)
```

Replay Attacks

- This design does not prevent replay attacks on IKE_SA_INIT
- Case 2 can leverage TLS to prevent on-path attackers and prevent replay of IKE_SA_INIT messages

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