IKE Context Transfer in an IPv6 Mobility Environment

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Summary

- Context Transfer use case: IPsec / IKEv2
- Solution against SPI collision : a MOBIKE extension
- Implementation of CXTP for IPsec / IKE in a IPv6 mobility environment
- Conclusion & Future work

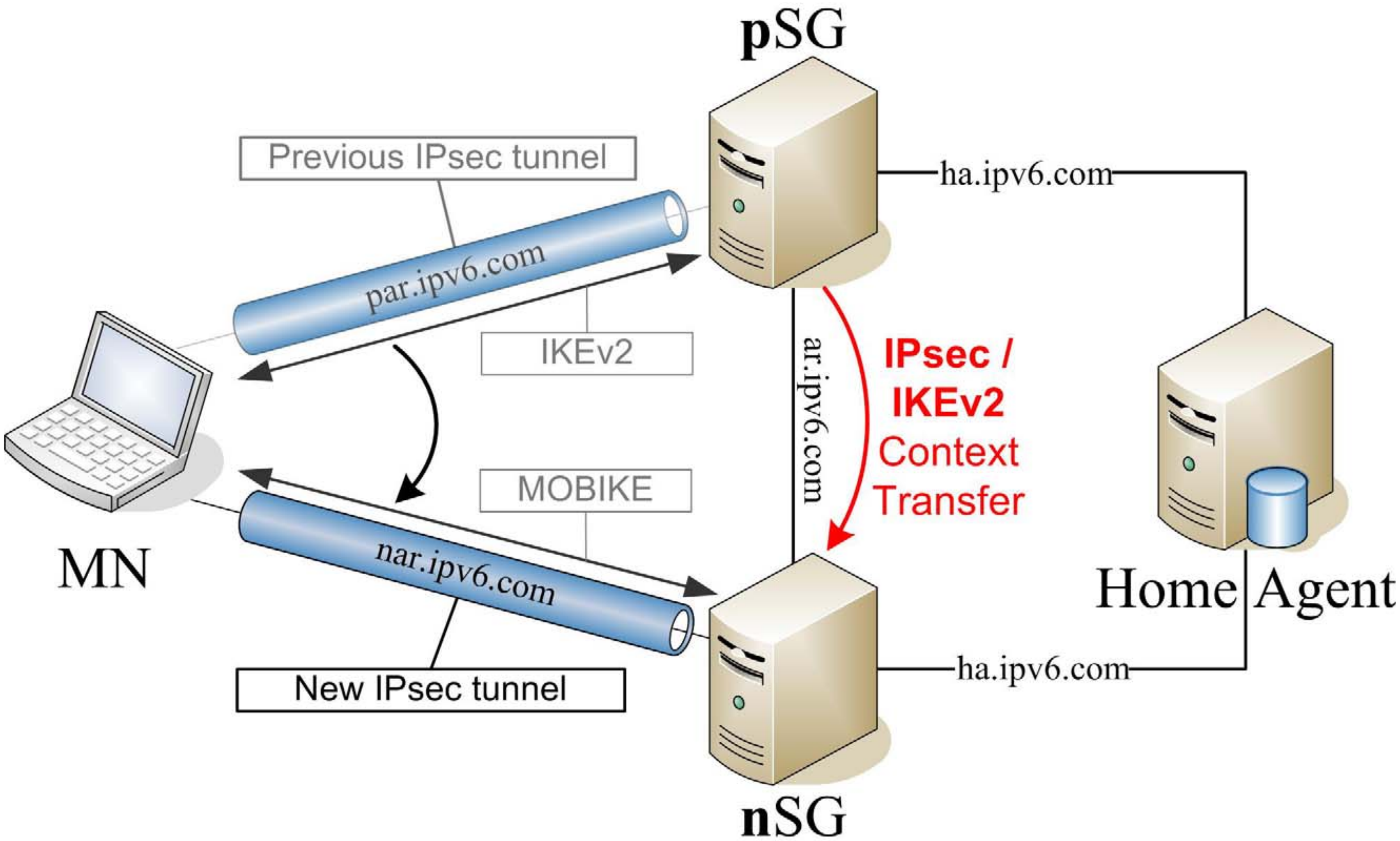
Context Transfer use case: IPsec / IKEv2

- Issue :
  - > Security provisioning is a major requirement in an all-IP-based network architecture providing multimedia services.
  - > In a mobility context, security between mobile nodes and network access equipments must be set up from scratch after each HandOver (HO) and for each customer
  - > In the case where an **IPsec tunnel** is dynamically set up between a Mobile Node (MN) and a Security Gateway (SG) using IKE
    - – **IPsec and IKE contexts** are created in the MN and the SG
  - > IKE signalisation
    - – lot of message exchanges (specially when EAP is used)
    - – cryptographic computation time for keys generation

  => takes a significant amount of time, crucially affecting the handoff performance

- Proposed solution to re-establish the security parameters :
  - > **Transfer of IPsec / IKE contexts between SG using CXTP** (RFC 4067)

Context Transfer use case: IPsec / IKEv2



pSG = previous Security Gateway

nSG = new Security Gateway

Context Transfer use case: IPsec / IKEv2

IPsec context = (SAD[1] + SPD[2] + PAD[3]) contexts + IKE[4] context

1. Security Association Database
   > Consulted in order to know how to process each packet (AH/ESP)
   - **SPI**, **Source/Destination IP addresses**, IPsec protocol (AH/ESP)
   - Sequence counter number, anti-replay window
   - AH/ESP algorithms and keys
   - IPsec mode (tunnel or transport)
   - Path MTU
   - IPsec SA lifetime

2. Security Policy Database
   > Defines the security policy to apply to each packet (IPSEC/BYPASS/DISCARD)
   - **Inner source/destination IP addresses**
   - Upper protocol
   - Security policy

Context Transfer use case: IPsec / IKEv2

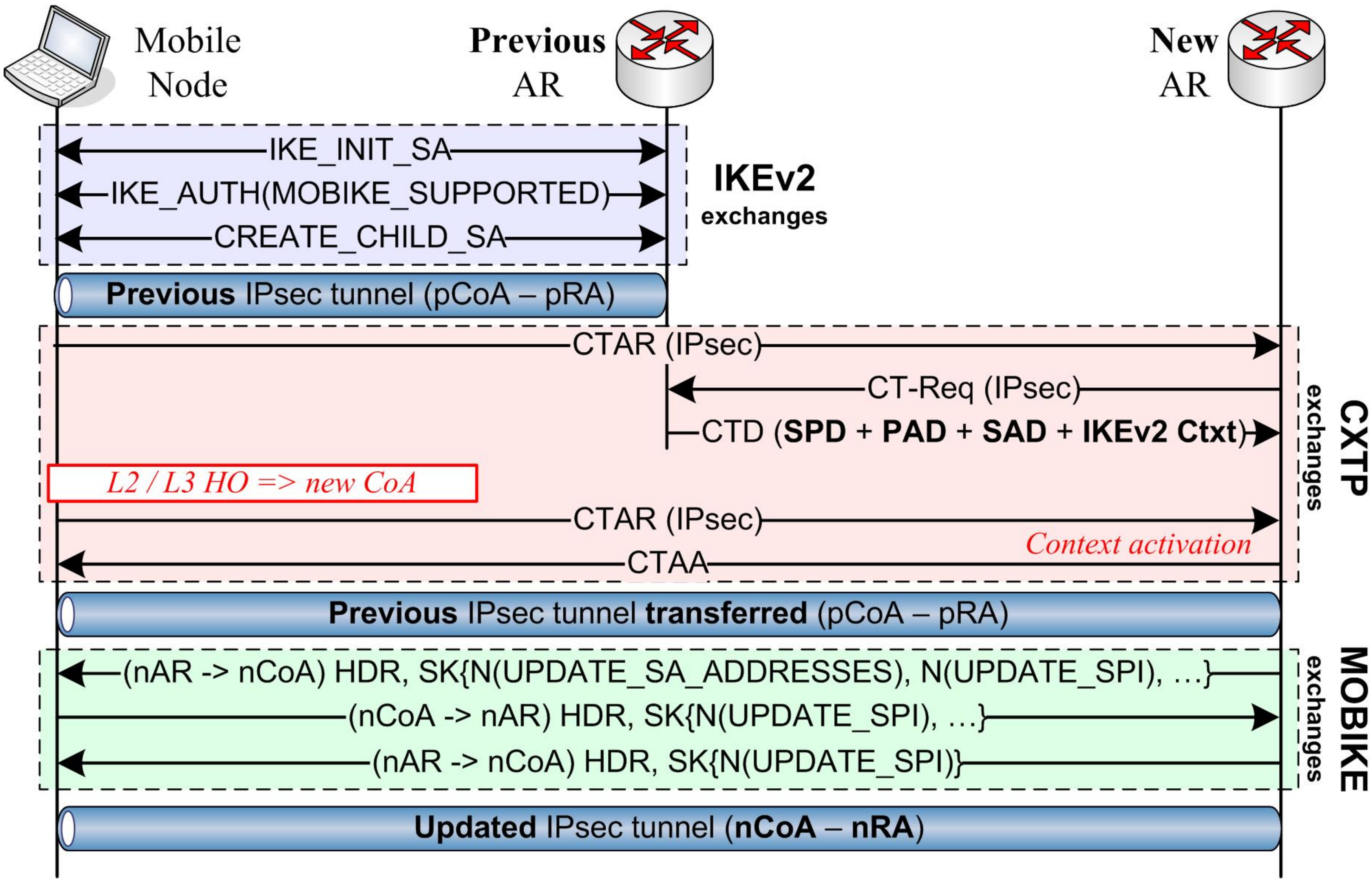
3. Peer Authentication Database
   > Identifies the peers that are authorized to communicate with the SG
     – Identifier
     – Authentication protocol and method
     – Pre-shared key or X.509 certificate

4. Internet Key Exchange
   > Sets up the IPsec SAs dynamically between two network equipments.
     – Initiator and responder **SPI**
     – Initiator and responder Nonces
     – Cryptographic algorithms
     – SKEYSEED (from which all keys are derived)
     – Lifetime

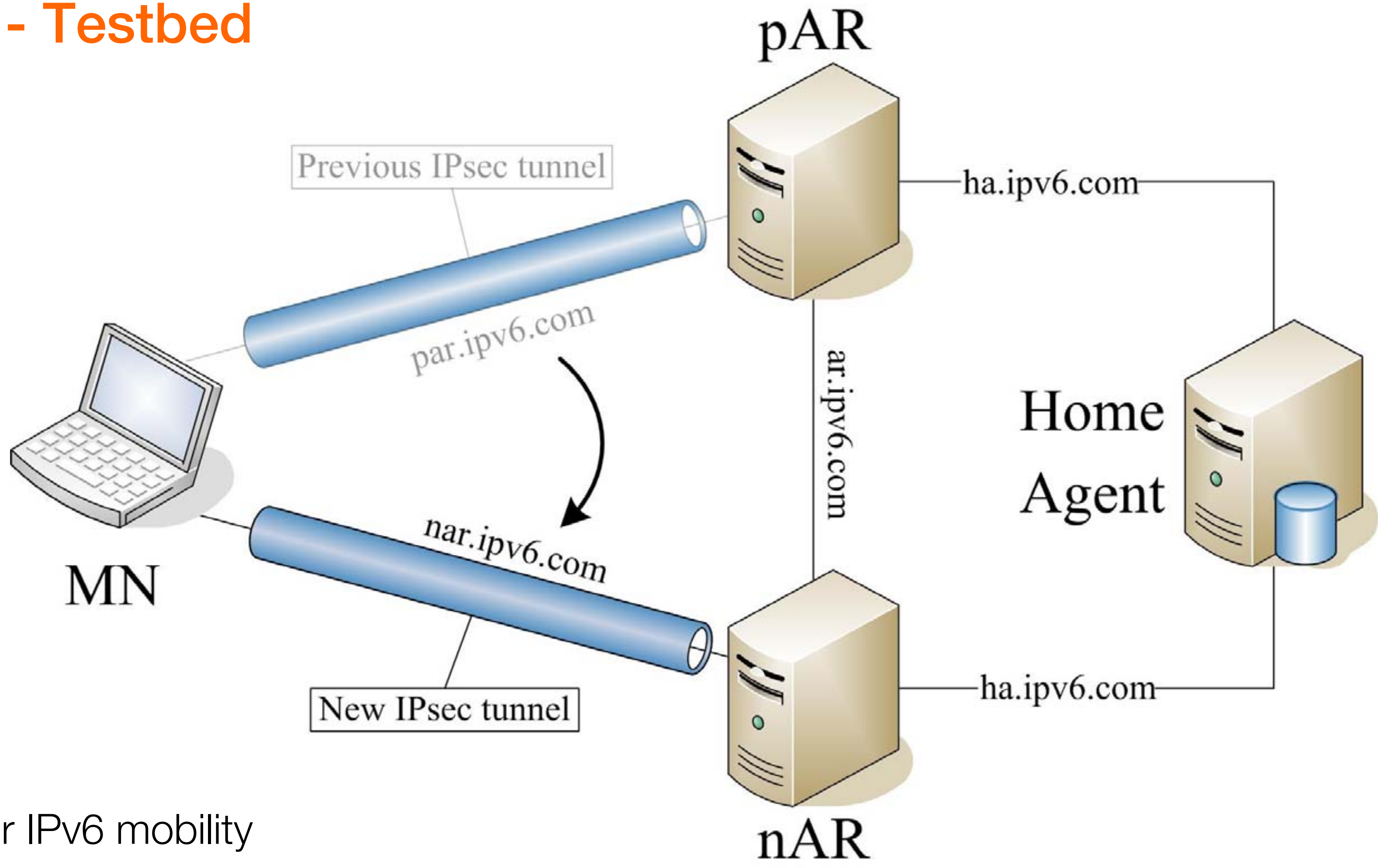
Solution against SPI collision : a MOBIKE extension

- SPI (Security Parameter Index)
  - > Uniquely identifies the initiator or responder of a SA
  - > **SPI** for IKE SA and **SPI** for IPsec SA
- Issue:
  - > After a Context Transfer, SPIs may need to be updated if they are already in use in the nSG **=> SPI collision**
  - > In this case, new SPIs must be negociated between the MN and the nSG
- Proposed solution:
  - > **Definition of a MOBIKE extension (UPDATE_SPI message type) in order to handle the SPI negociation between the MN and the nSG**
- What is MOBIKE ?
  - > IKEv2 Mobility and Multihoming Protocol
  - > Allows to update IP addresses of an IPsec tunnel created with IKEv2

Solution against SPI collision : a MOBIKE extension



Implementation of CXTP for IPsec / IKE in a IPv6 mobility environment - Testbed



- Local platform
  - > FreeBSD
  - > KAME snap for IPv6 mobility support
  - > Racoon for IKEv1 negociation

Implementation of CXTP for IPsec / IKE in a IPv6 mobility environment - Results

- UDP traffic generator with 50ms delay between each packet.
- Mobile IPv6 HO delay is not take into account.
- Only focused on the security set up delay
  - > during this time, all UDP packets are lost

	Average delay (in ms)	Number of messages	Total size of messages (in Bytes)
IKEv1 main mode	1500	11	2182
IKEv1 aggressive mode	1300	8	1896
IKEv1 with context transfer optimisation	20	1	106

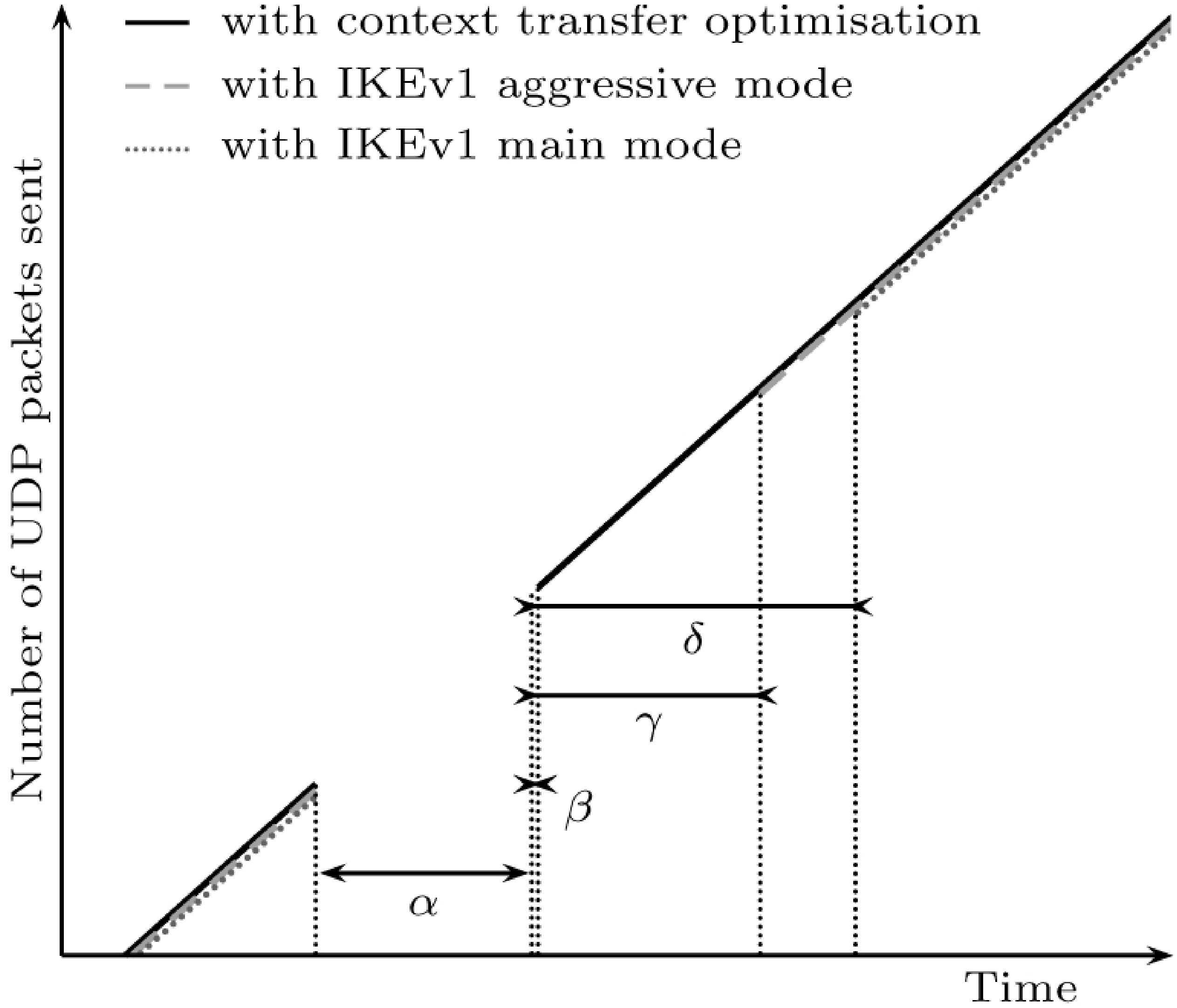
Conclusion & Future work

- Paper set out
  - an application of the context transfer for IPsec/IKE
  - a solution against the SPI collision using a MOBIKE extension
  - a set of practical results showing that CT for IPsec can drastically reduce the time needed to re-establish an IPsec tunnel after a HO.
- Main gains of context transfer for security
  - Performance improvements for IPv6 mobility environment
  - Less security signalisation in the core network
- Future work
  - CXTP for IKEv2 implementation
    - Comparison results with and without using CT optimisation

Questions ?

Implementation of CXTP for IPsec / IKE in a IPv6 mobility environment - Results

- α
  - > HO delay
- β
  - > IKEv1 with CT optimisation delay to re-establish the IPsec tunnel
- γ
  - > IKEv1 in *aggressive* mode delay to re-establish the IPsec tunnel
- δ
  - > IKEv1 in *main* mode delay to re-establish the IPsec tunnel



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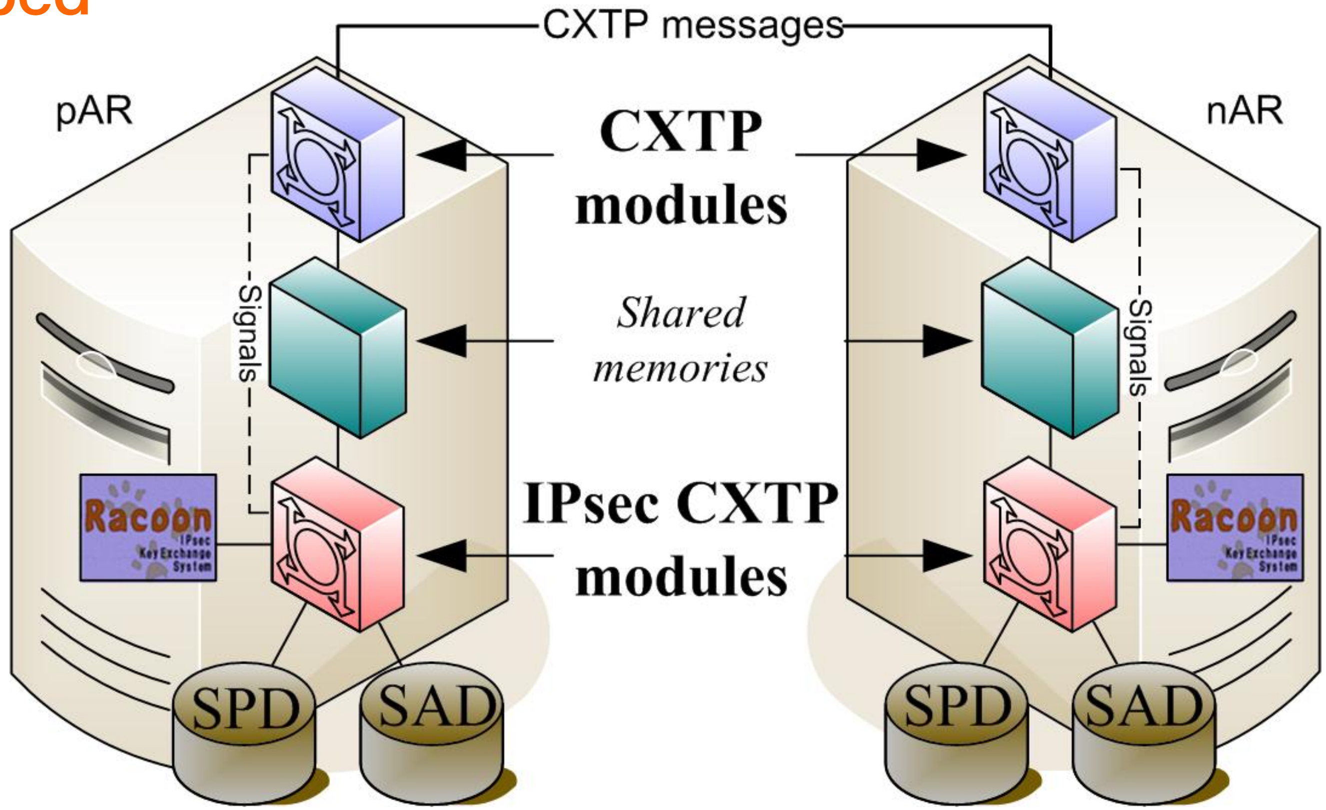

- CXTP module
  > follows RFC4067
- IPsec CXTP module
  > PF_KEYv2 API
  > links CXTP module with FreeBSD kernel's databases (*SAD* + *SPD contexts*)
  > links CXTP module with Racoon (*IKEv1 context*)
- Communication through a shared memory