OST
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Secure Protocols

Get to know each other

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CAS Cyber Security

Intro

Goals of Secure Protocols

- Neither a passive eavesdropper nor malicious, active adversary can defeat this.
- Apply crypto mechanisms the correct way to achieve a secure protocol

Participants

- Alice, Bob, Trent, Eve, Mallory
- Trent (trusted third party TTP, CA, KDC)
- Eve (passive eavesdropper - cannot influence protocol)
- Mallory (may alter, drop, inject, replay, delay, hijack traffic, but cannot break crypto or cause DoS)

Authentication

What is authentication?

- Data origin authentication (ISO 7498-2 origin verification)
- Entity authentication (ISO 7498-2 identity verification)

Entity authentication

- Unilateral (entity) authentication
- Mutual (entity) authentication
- Both might be encryption, MAC or signature-based

Authentication requirements (avoid reflection and replay attacks)

- **Authenticity of data origin**
- **Freshness (not being used before -> eg. nonce)**
- **Liveness (its not an old message -> eg. time-stamp, logical-ts, sequence nr)**
- **Protocol must embed identities**

See ISO-9798 for more details on entity authentication

Key Agreement

Motivation for key agreement

- Communicate securely for the duration of a session
- For that reason the authentication protocol gets pimped
- Result is a authenticate key agreement protocol (AKE)

Public/Private Key Agreement

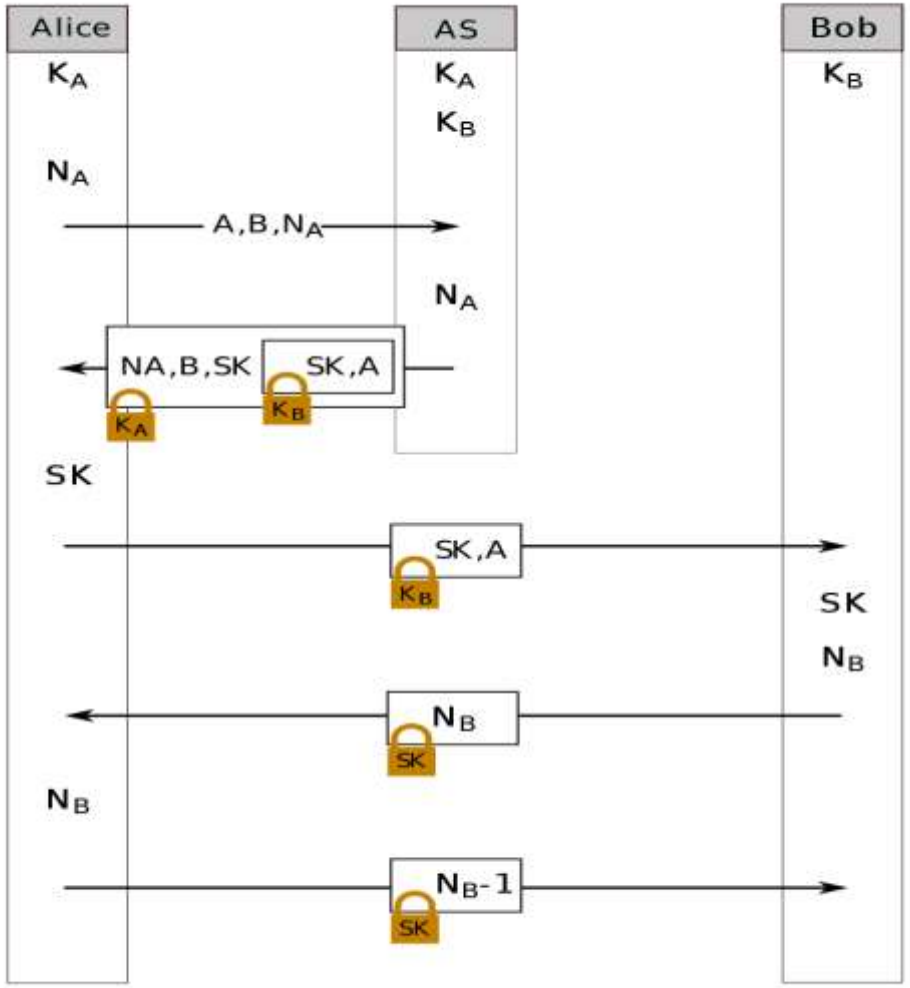
- Alice => Bob: {Session-Key}Public-Key$_{Bob}$
- K_{MAC} = HMAC(Session-Key || 'MAC')
- K_{ENC} = HMAC(Session-Key || 'ENC')

Diffi-Hellmann Key Agreement

- Alice --> Bob: g^X modulo p
- Bob --> Alice: g^Y modulo p
- $(g^Y)^X$ modulo p = g^{XY} modulo p

Trusted Third-Party

Needham-Schroeder Protocol



Mutual Authentication

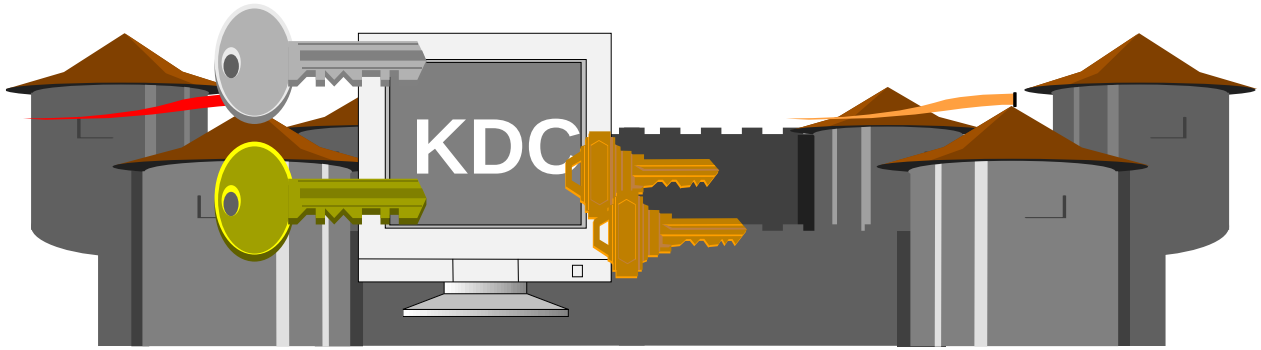
- Messages 4 and 5 must contain an Nonce to be able to authenticate B to A

Warning

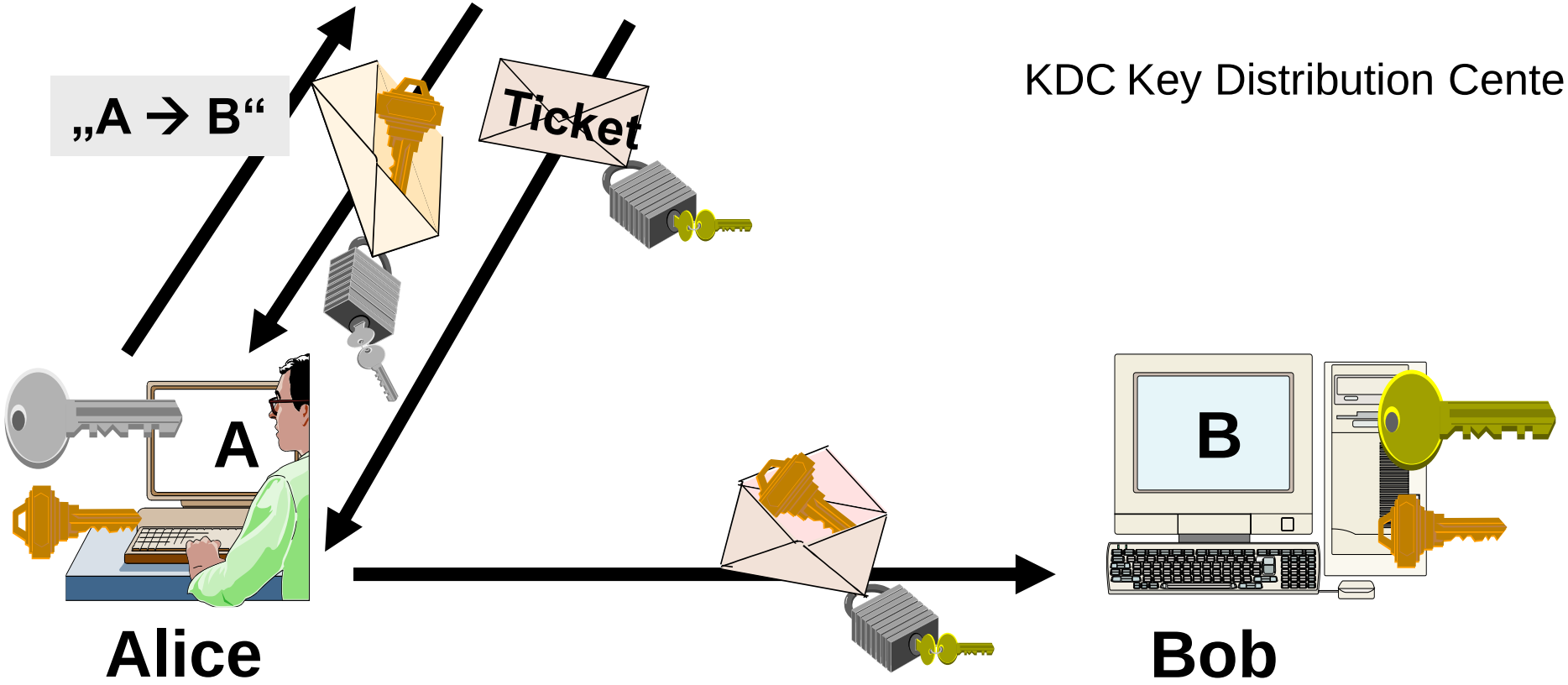
- The protocol is vulnerable to replay attacks

Source https://upload.wikimedia.org/wikipedia/commons/4/4b/Symetric_Needham-Schroeder-Protocol_%E2%80%93_linear.svg

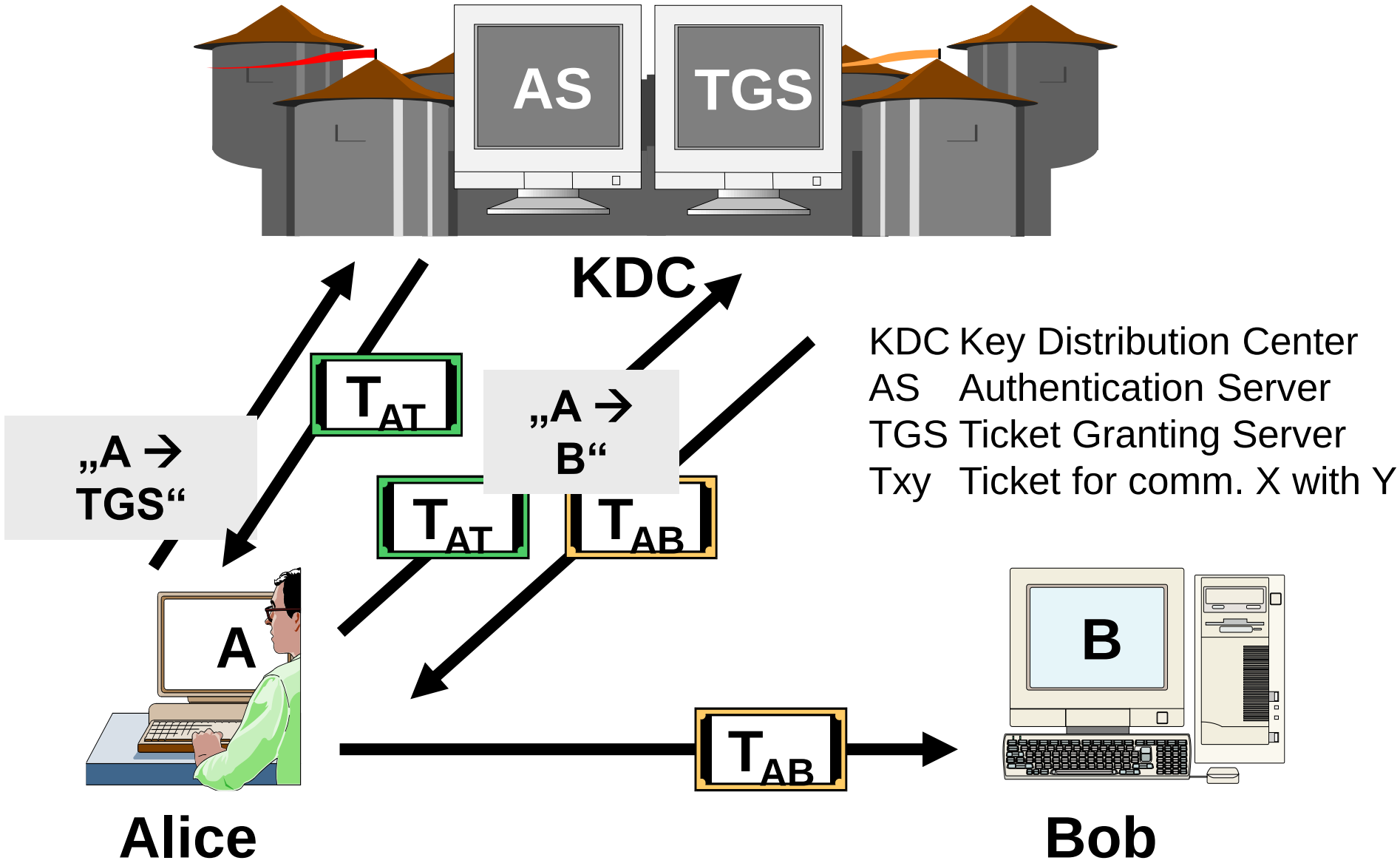
Kerberos Basic Principles



KDC Key Distribution Center



Kerberos Standard Procedure



KDC Key Distribution Center
AS Authentication Server
TGS Ticket Granting Server
Txy Ticket for comm. X with Y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