Network Security - Week 4

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DCC/FCUP

2025

Alternative authentication - Kerberos

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In Security

- An authentication protocol
- Guards the entrance to some realms
- Designed for smaller scale, e.g. LANs
- Relies on a Trusted Third Party (TTP)

Motivation for Kerberos

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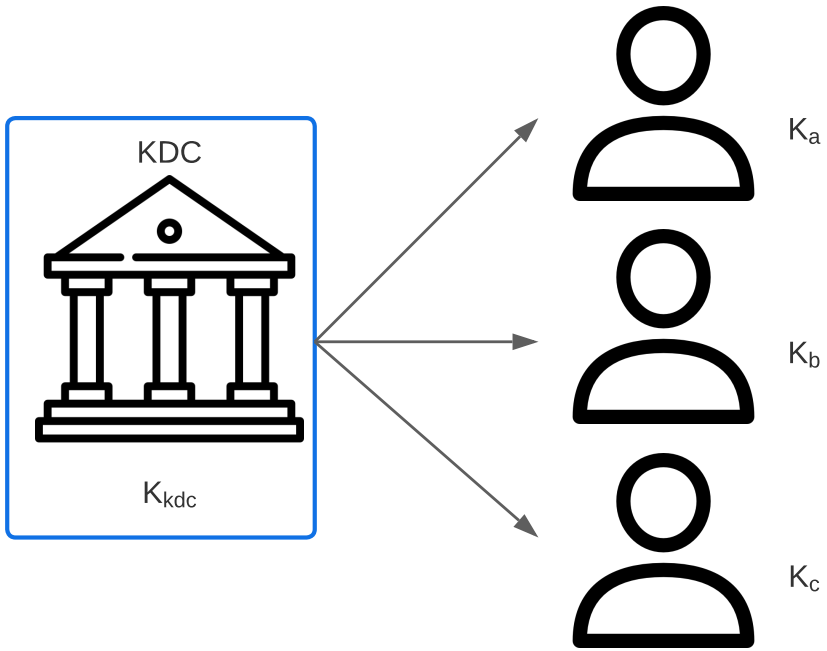
Kerberos is based on symmetric keys, but only requires N keys.

- *Assumption:* Security depends on TTP
- No PKI necessary!

A Trusted Key Distribution Center



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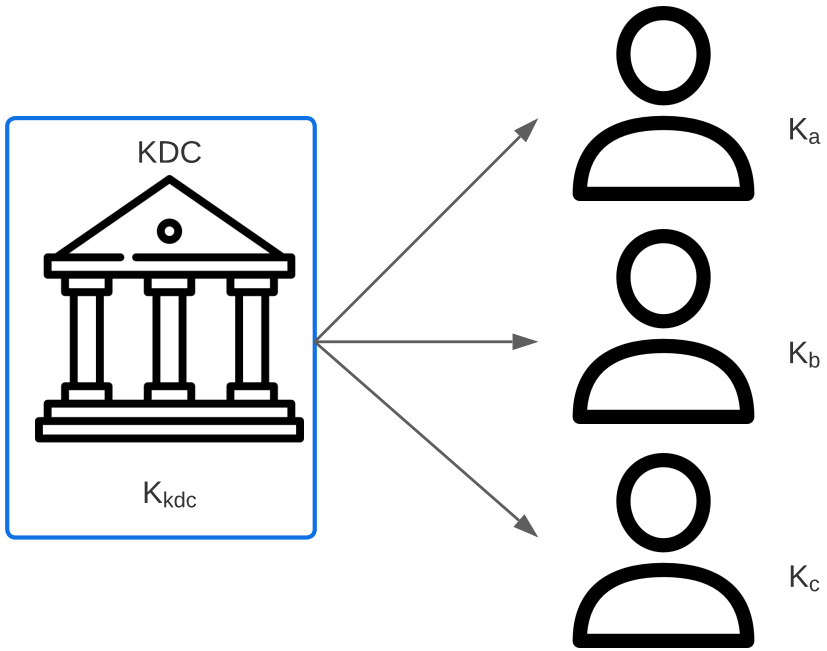

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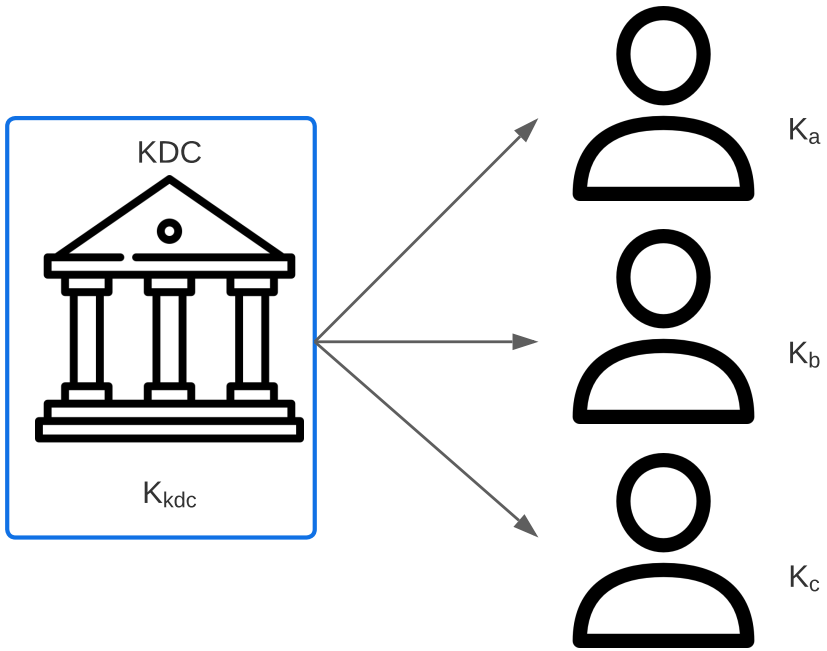

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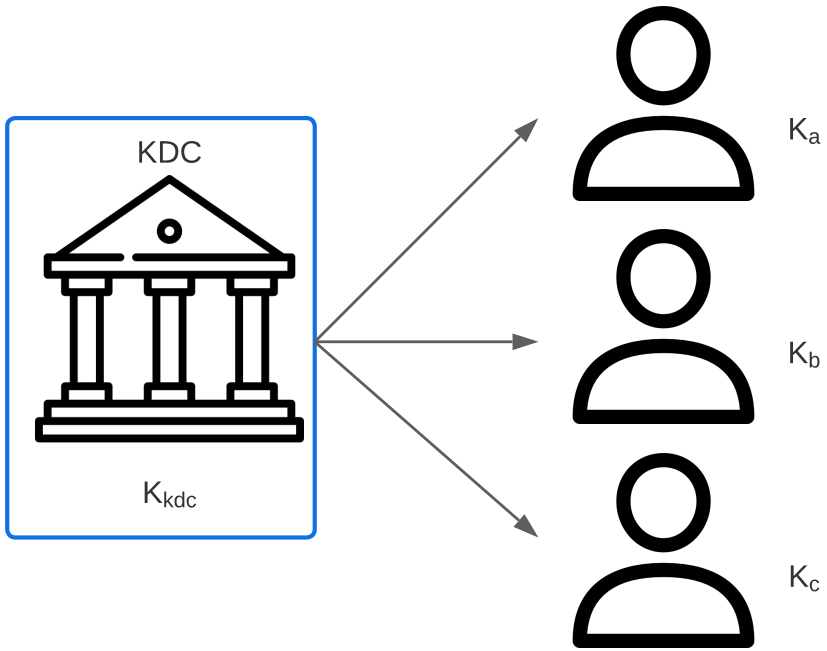

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- Enables authentication and session keys

Kerberos Authentication

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TGTs

- Each TGT contains:
  - Session key
  - User ID
  - Expiration time
- Used to avoid having the KDC manage a database
- KDC remains (mostly) stateless

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The good and the bad

- **Good:** Security is transparent for Alice
- **Bad:** KDC must always be secure!

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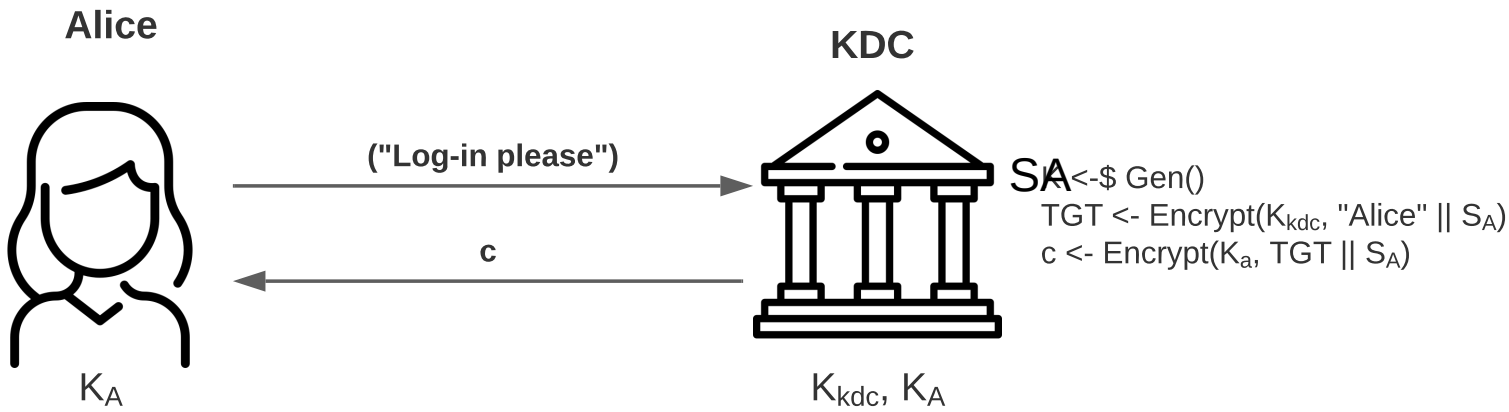

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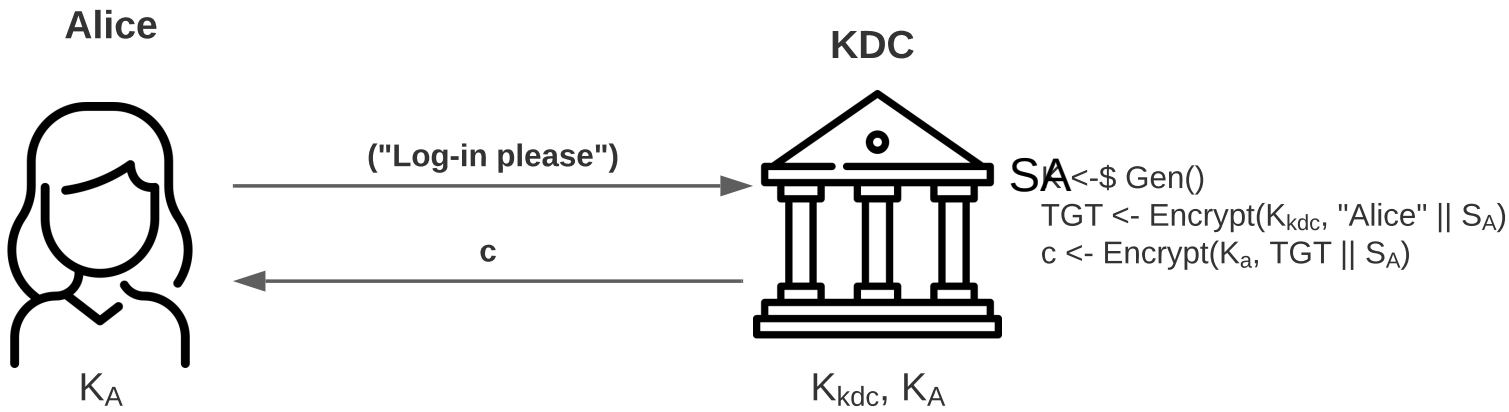

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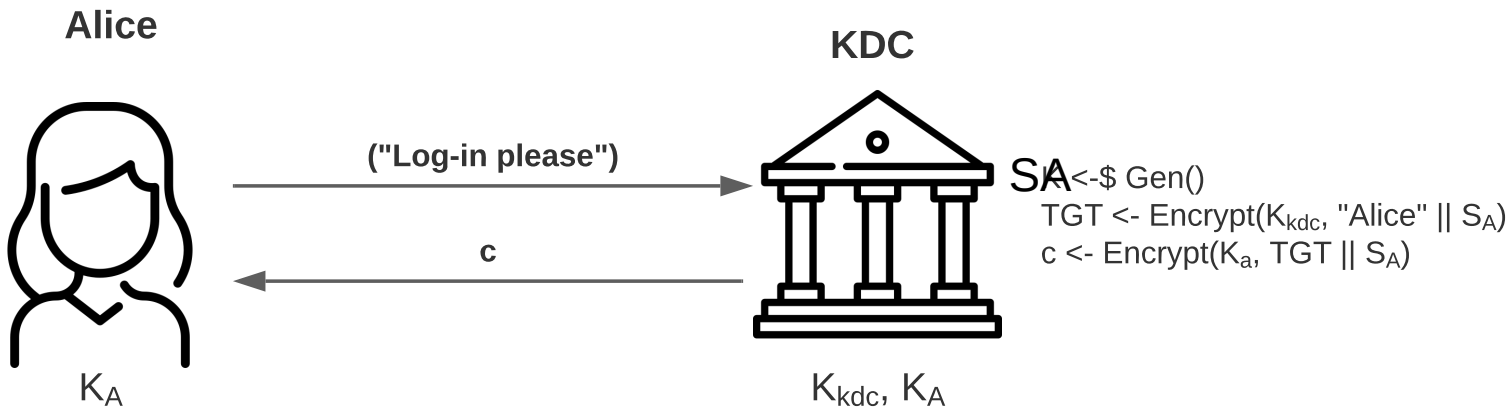

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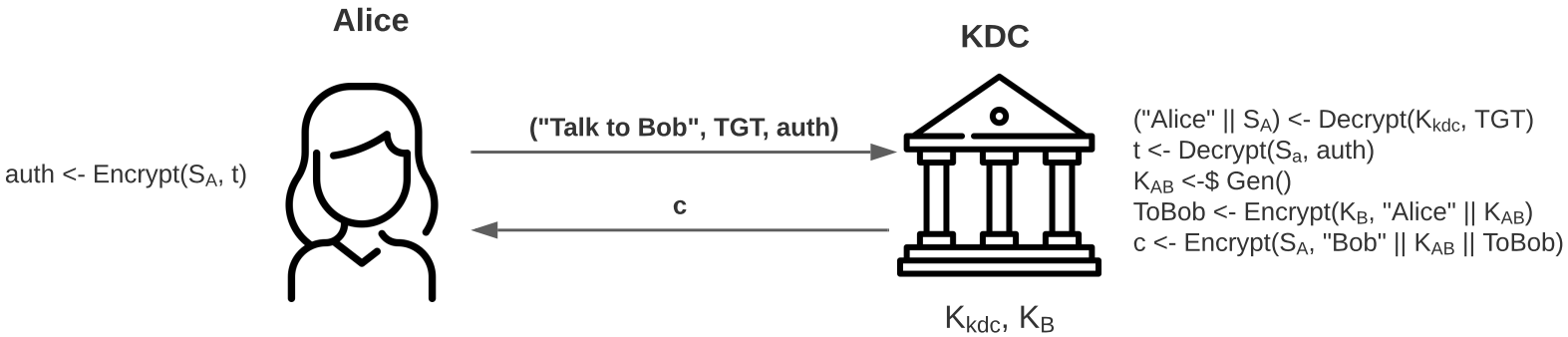
- Alice retrieves S_A and TGT

Kerberos Talk to Bob - P1



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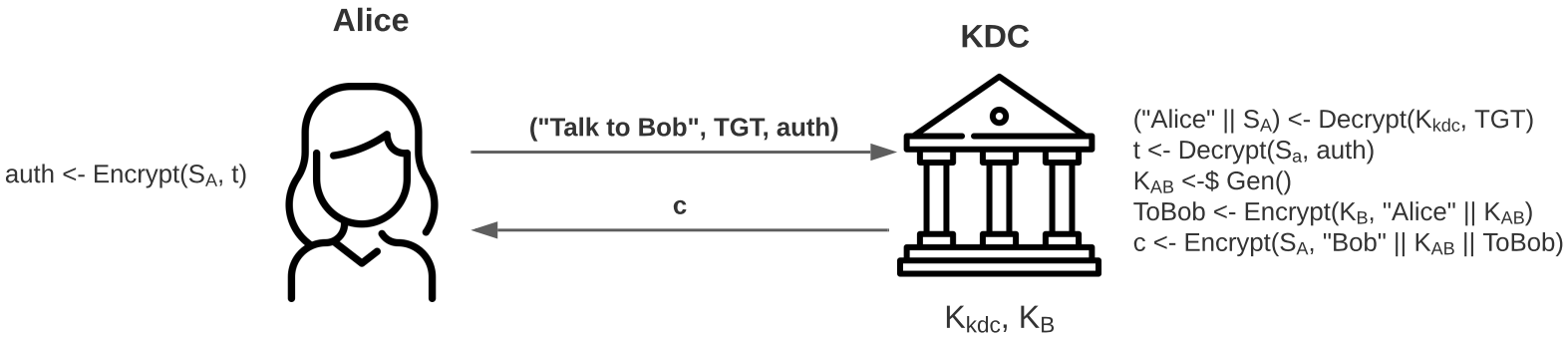

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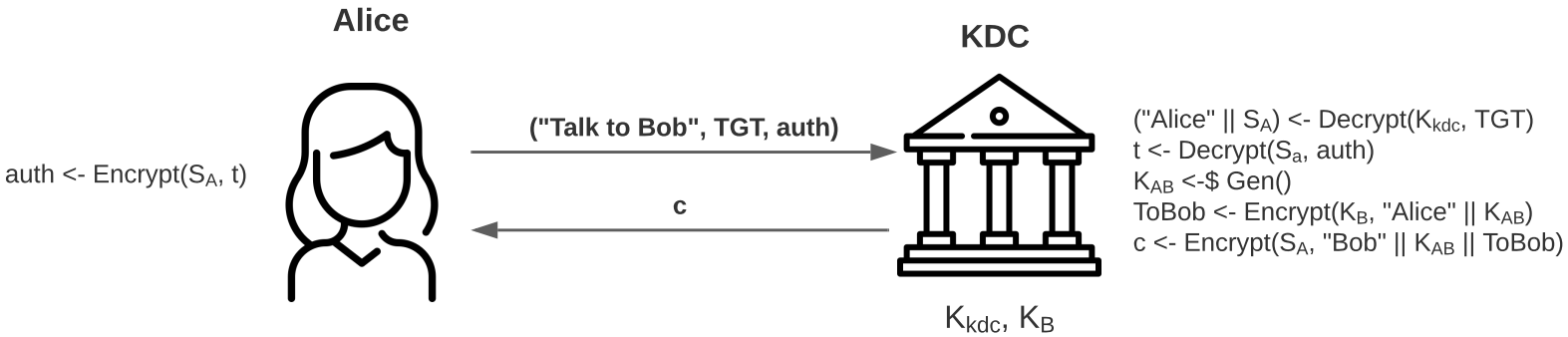

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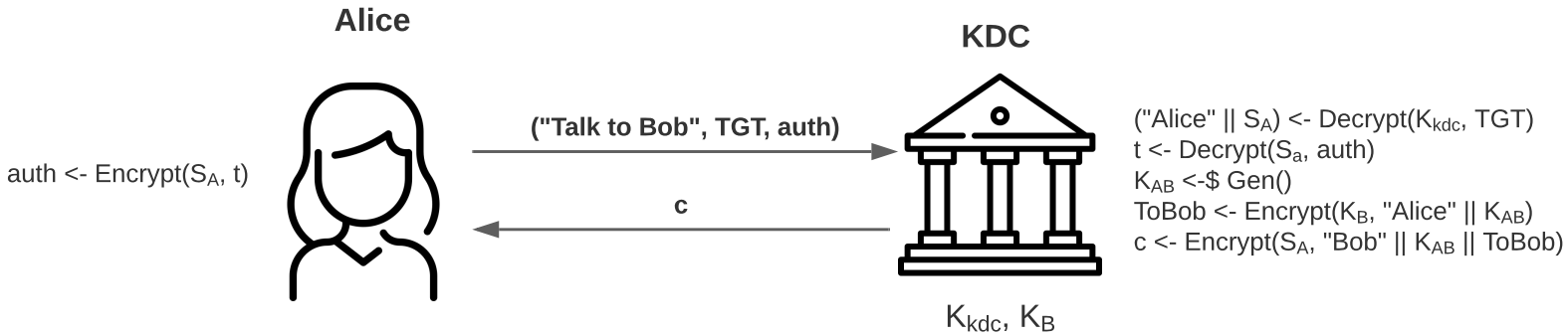

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- Alice retrieves K_{AB} and an authenticator it can send to Bob

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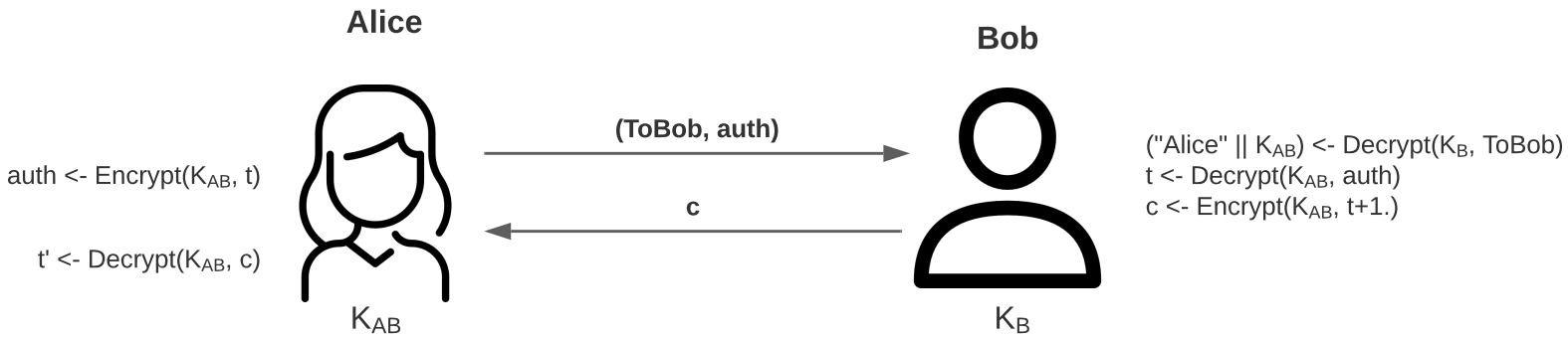

- Bob knows its own key K_B

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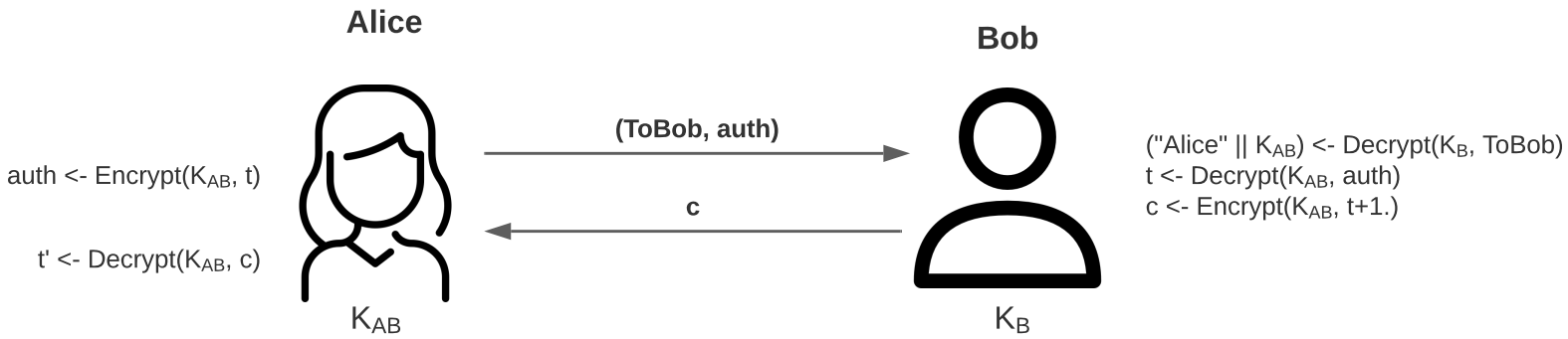

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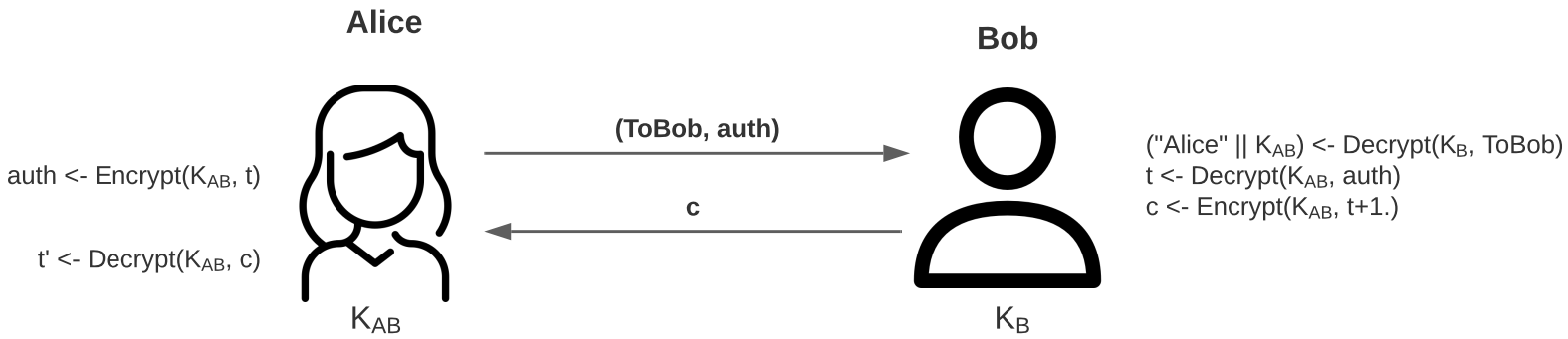

- Bob knows its own key K_B
- Alice sends ToBob, and an authenticator encrypted with K_{AB}
- Bob does not know K_{AB}...
  - But the ToBob token has K_{AB}, encrypted with K_B
  - Retrieves K_{AB} and checks the authenticator for freshness
  - Encrypts a reply with the updated timestamp

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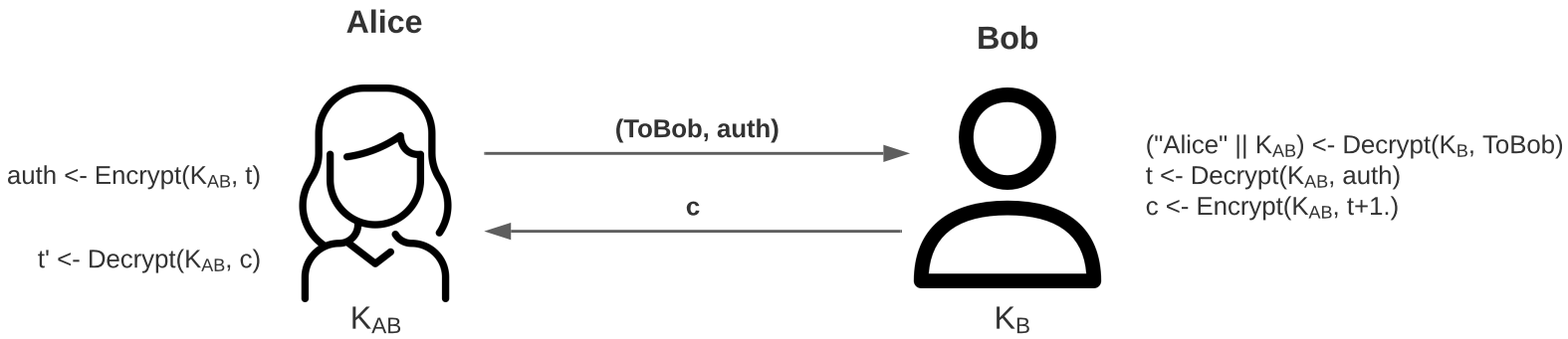

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  - Encrypts a reply with the updated timestamp
- Alice decrypts the reply and checks for freshness

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- “time” is a security-critical parameter!

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  - Allows for the anonymity of Alice!
- Why doesn't the KDC sent the ticket to Bob?
  - Bob would have to remember K_{AB}
  - It's good to remain stateless!
- Can't we have the KDC remember the session key instead of using the TGT?
  - Yes... but it's good to have the KDC remain stateless
  - Scales better!

Wrap up

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- An alternative system for authentication
- Trusted hardware assumption - KDC
- Ticket Granting Tickets
  - Allows for stateless resource management

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