A Method for Password-free Authentication

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19. December 2013

Introduction

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  - short, easy and used multiple times

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  - free, easy, secure

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  - public key
  - private key

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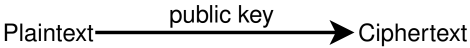

Plaintext

public key

Ciphertext

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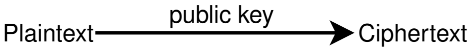

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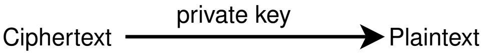
Decryption:



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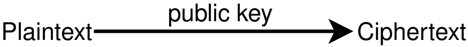

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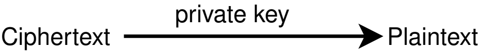

Ciphertext

private key

Plaintext

- asymmetric

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Signing:

Plaintext $\xrightarrow{\text{private key}}$ „Ciphertext“ (signed plaintext)

Verification:

„Ciphertext“ $\xrightarrow{\text{public key}}$ Plaintext

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- asymmetric $\equiv$ Public-Key-Cryptography

Overview & Preparation

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- signed data identifys the unique user

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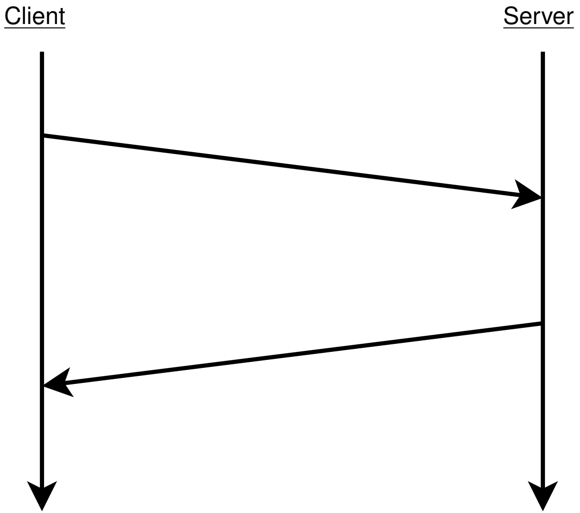
The Server

- has the public key of the client
- and it is associated with the user account

PKWL 1.0 - Signed Messages



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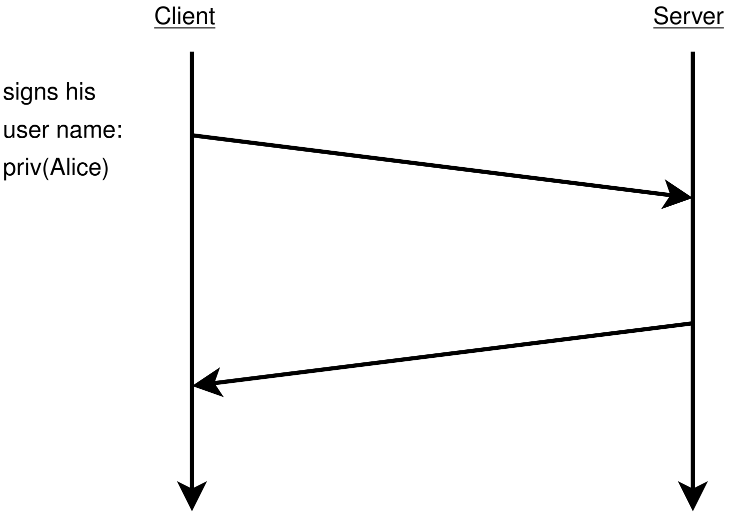

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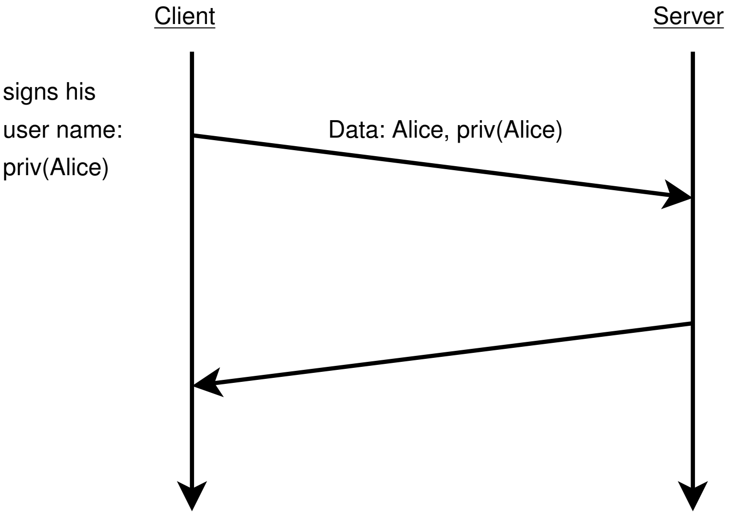

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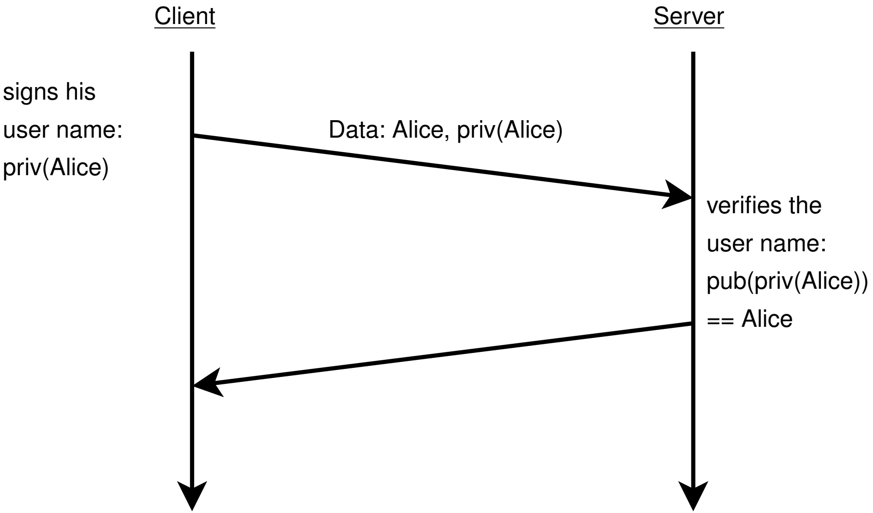
Client
Server
signs his user name: priv(Alice)
Data: Alice, priv(Alice)
verifies the user name: pub(priv(Alice)) == Alice

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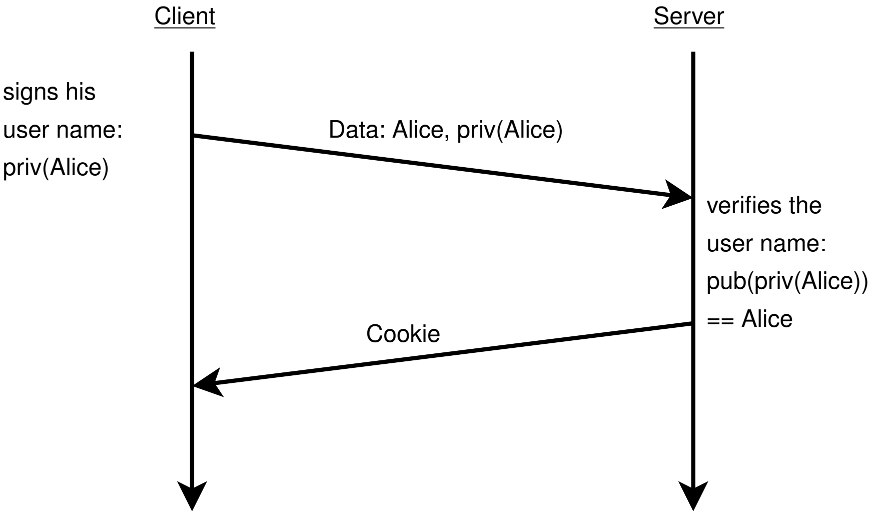

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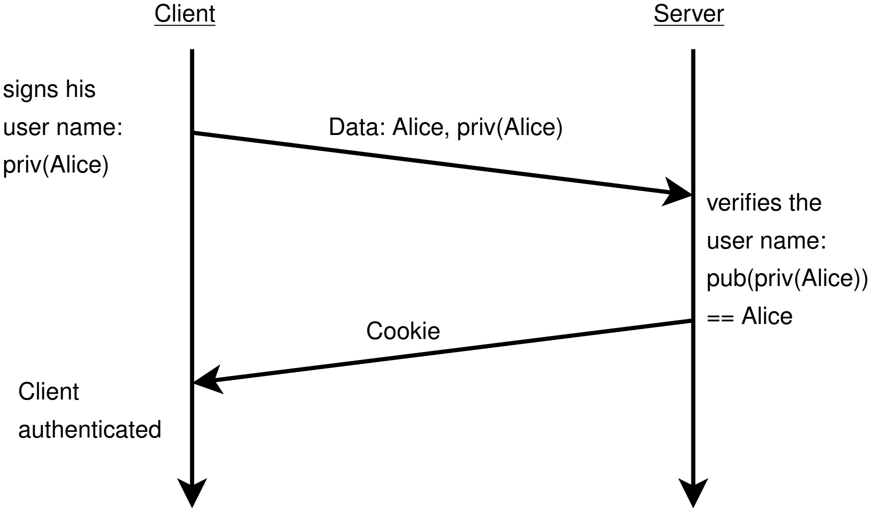

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Cookie

Client authenticated

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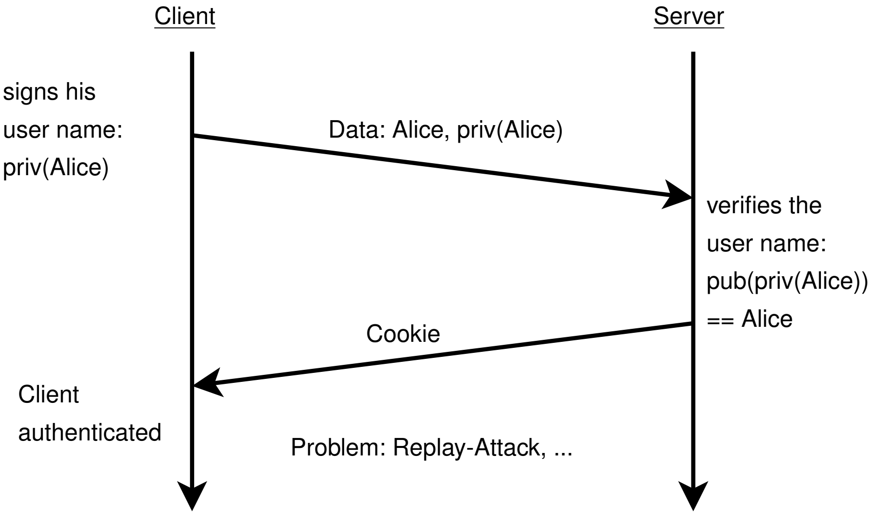

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Cookie
Client authenticated

Problem: Replay-Attack, ...

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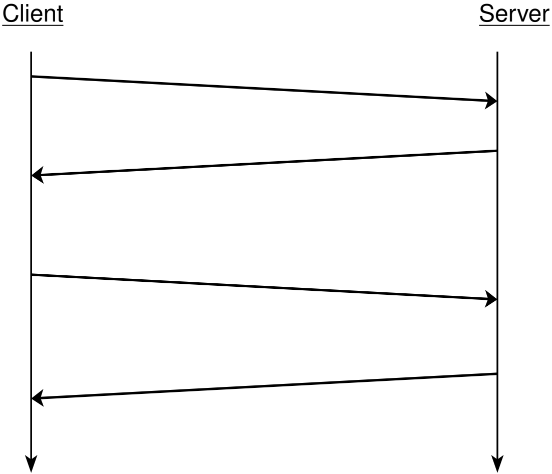

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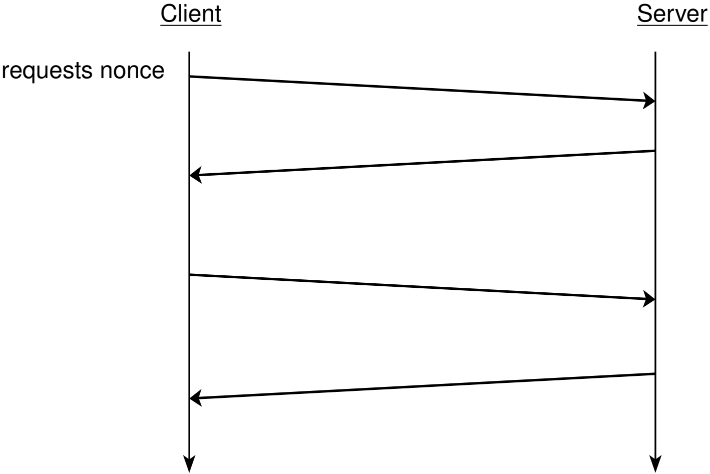

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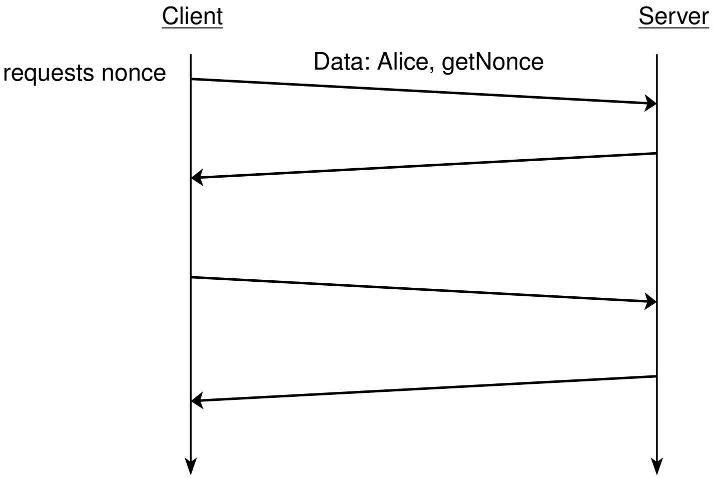

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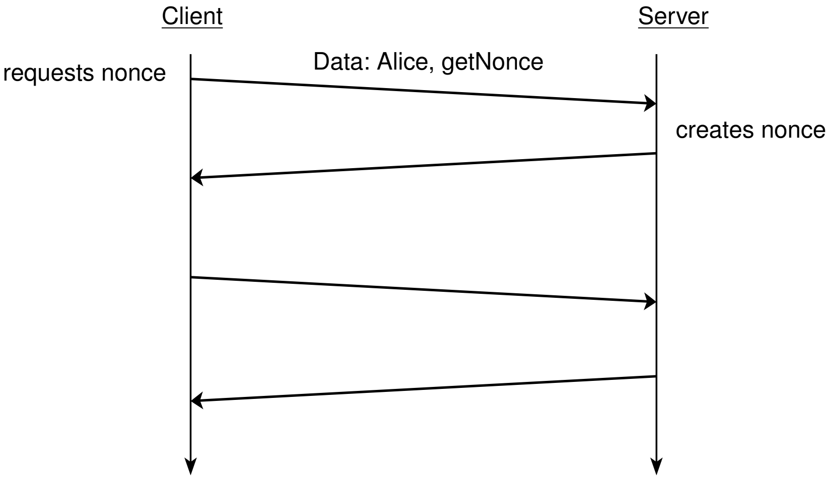

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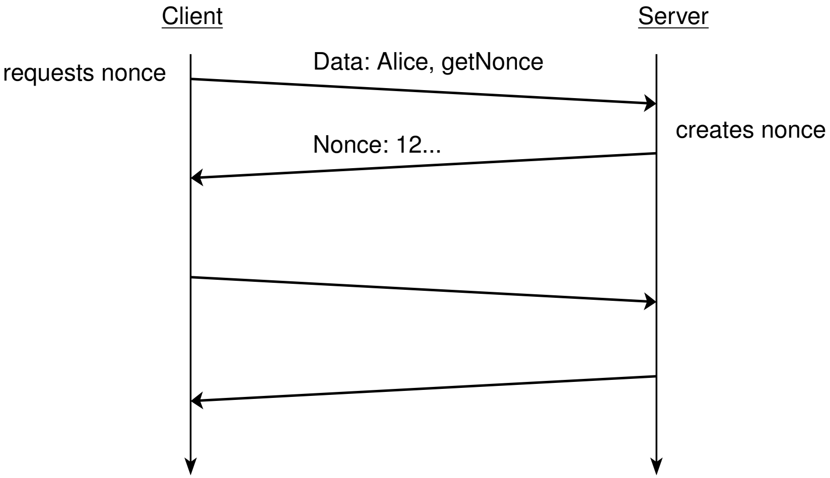

Client

Server

requests nonce

Data: Alice, getNonce

creates nonce

Nonce: 12...

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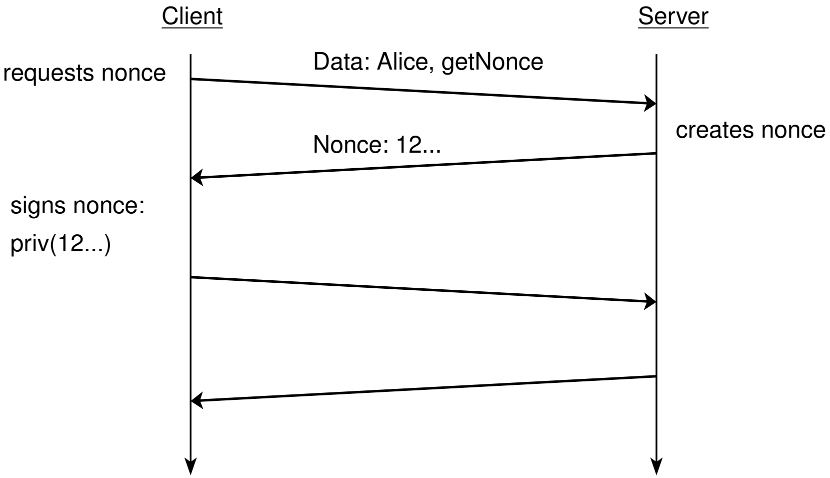

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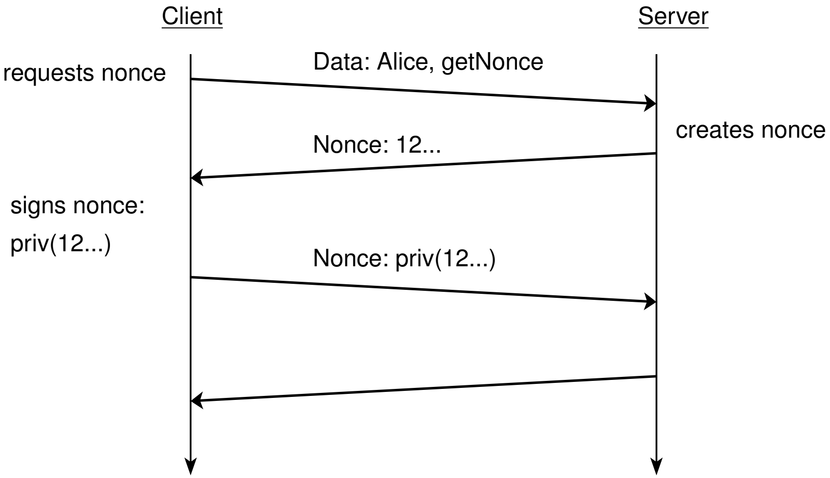

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requests nonce

Data: Alice, getNonce

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Nonce: 12...

signs nonce:

priv(12...)

Nonce: priv(12...)

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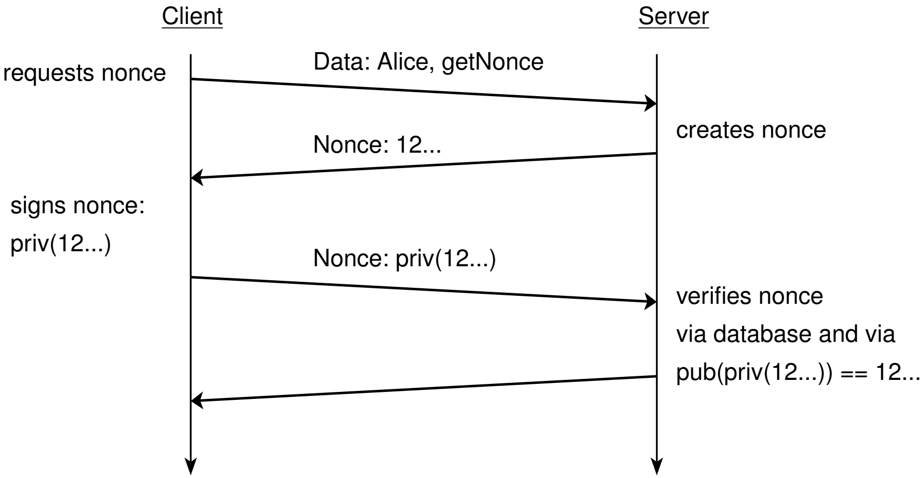

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Nonce: 12...

signs nonce:

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Nonce: priv(12...)

verifies nonce

via database and via

pub(priv(12...)) == 12...

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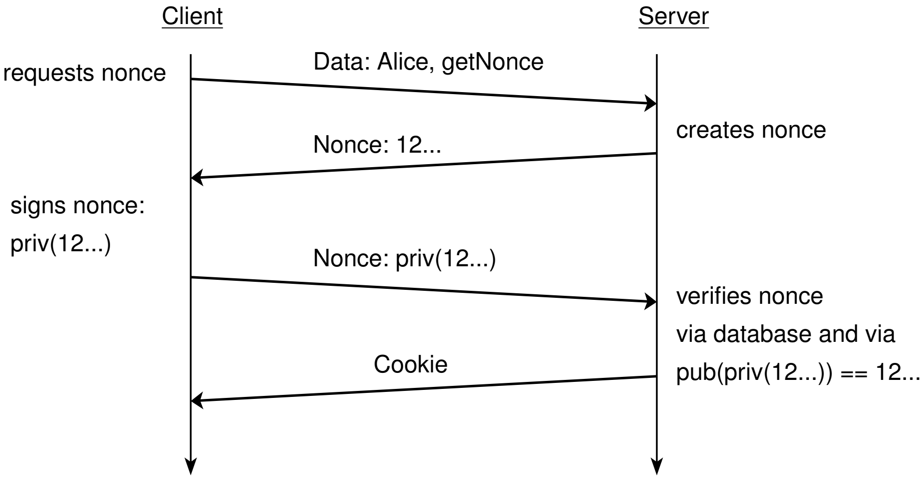

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Cookie

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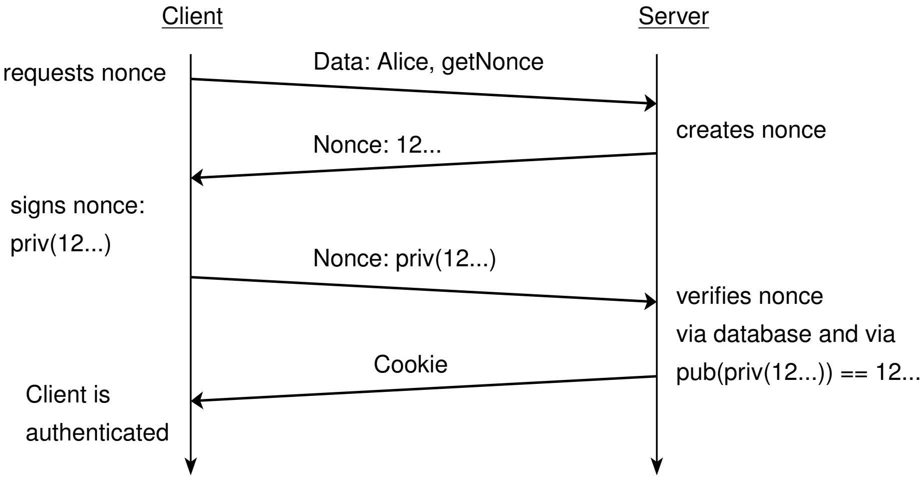

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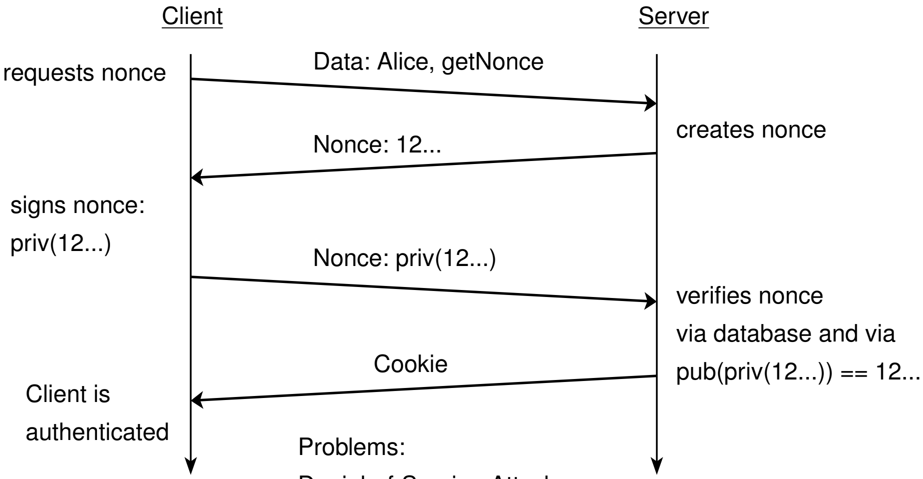
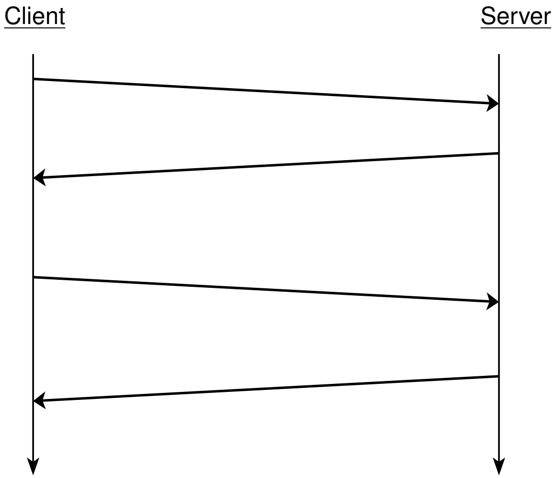


Problems:
Denial-of-Service-Attack,
malicious nonce, ...

PKWL 2.0 - Proof-of-Work-System



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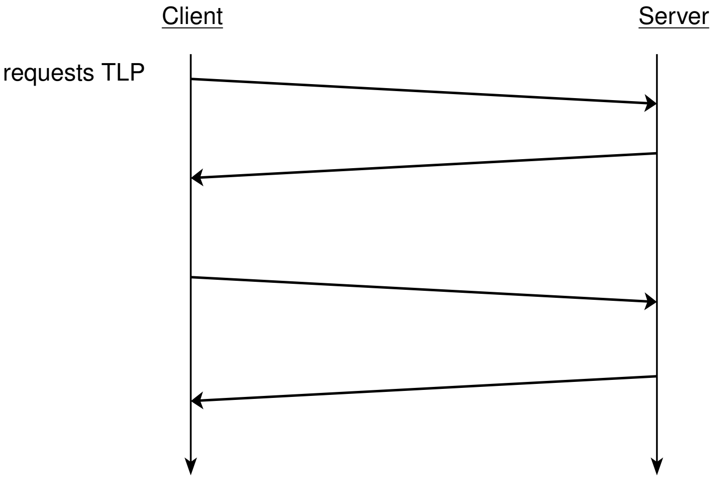

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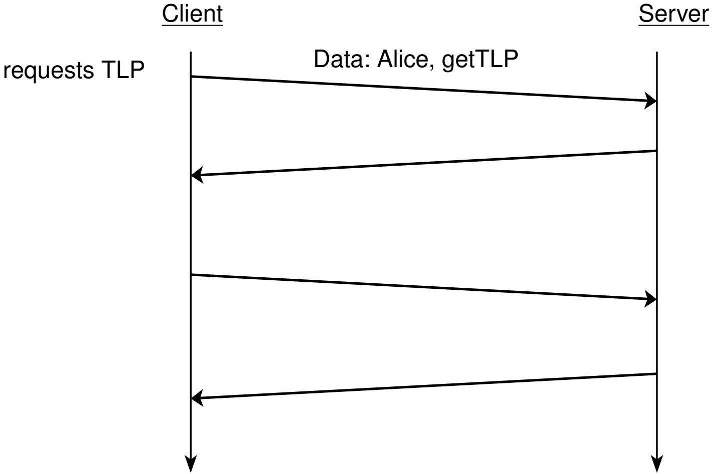

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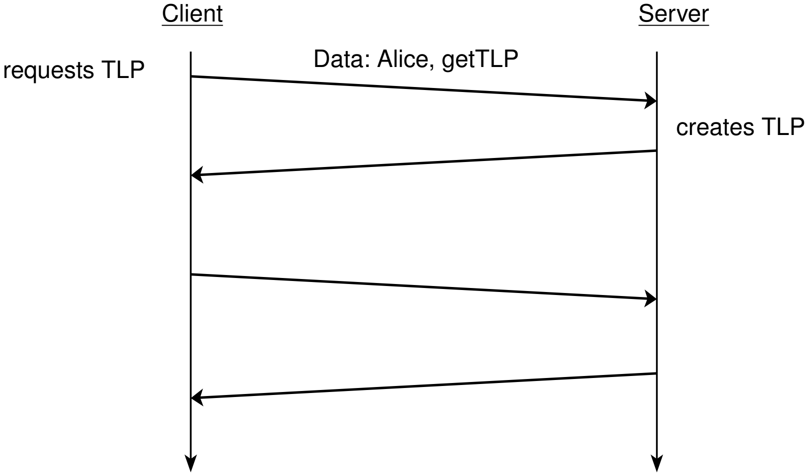

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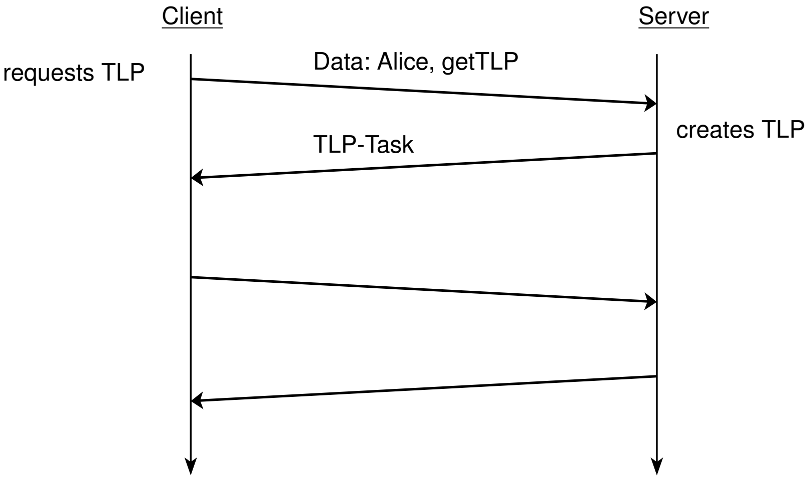

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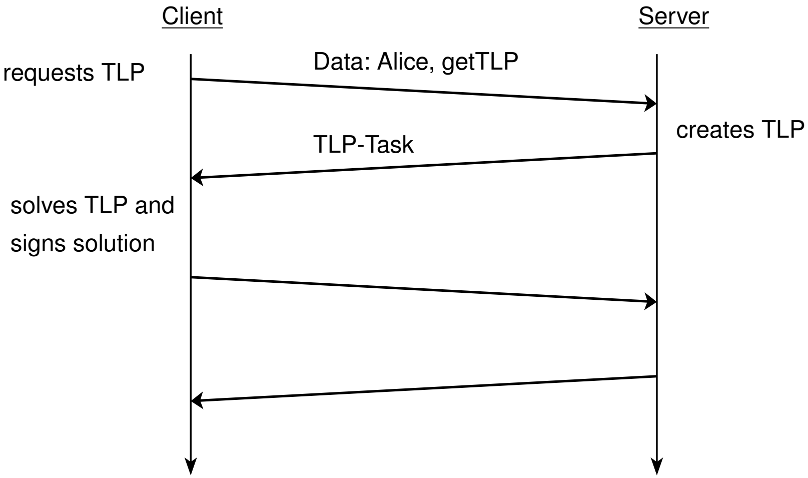

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requests TLP

Data: Alice, getTLP

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TLP-Task

solves TLP and signs solution

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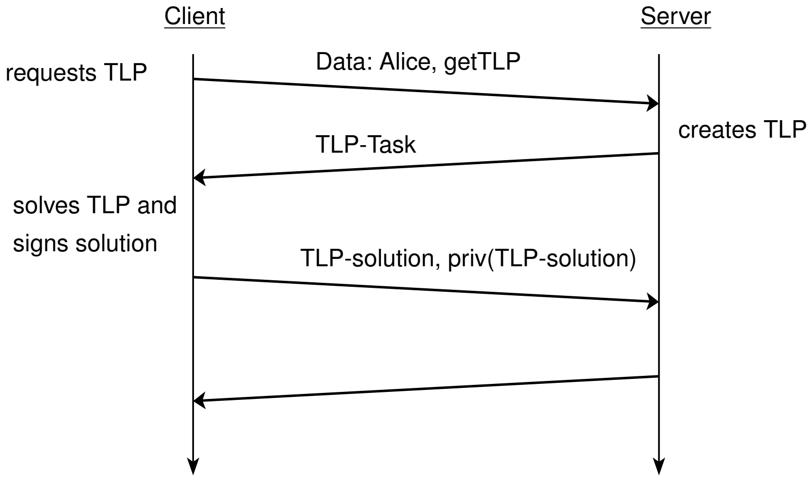

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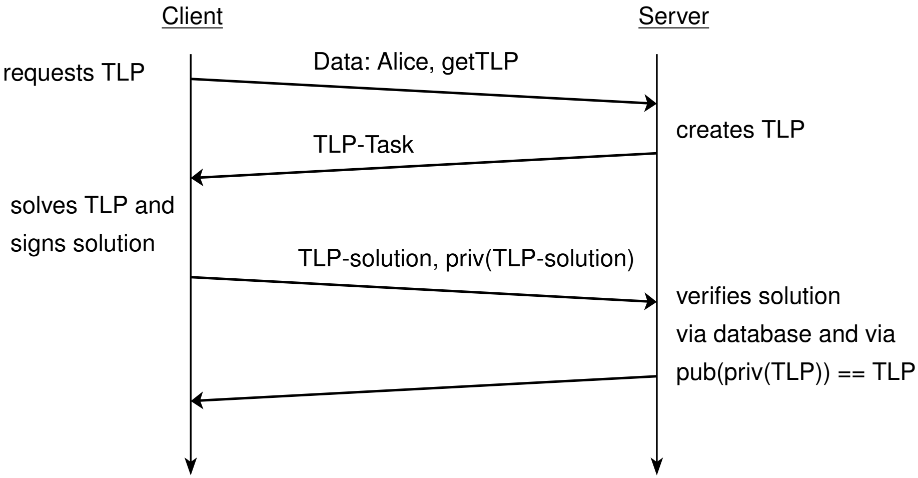

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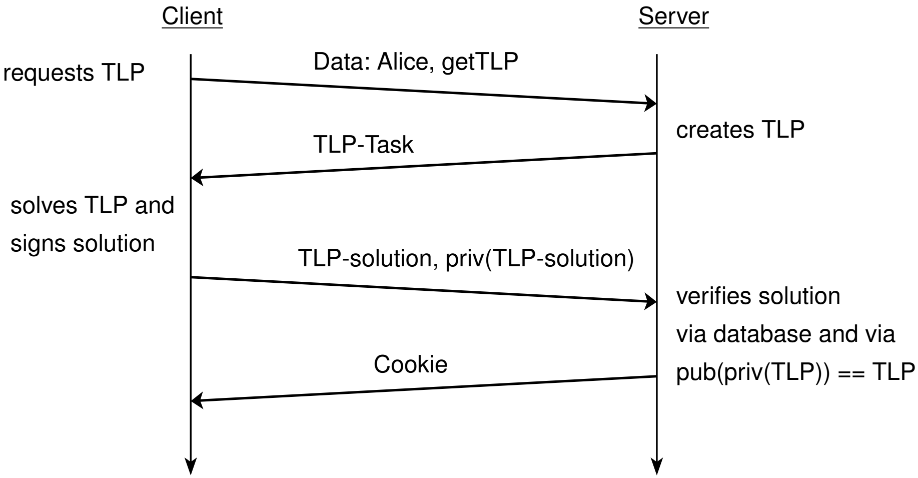
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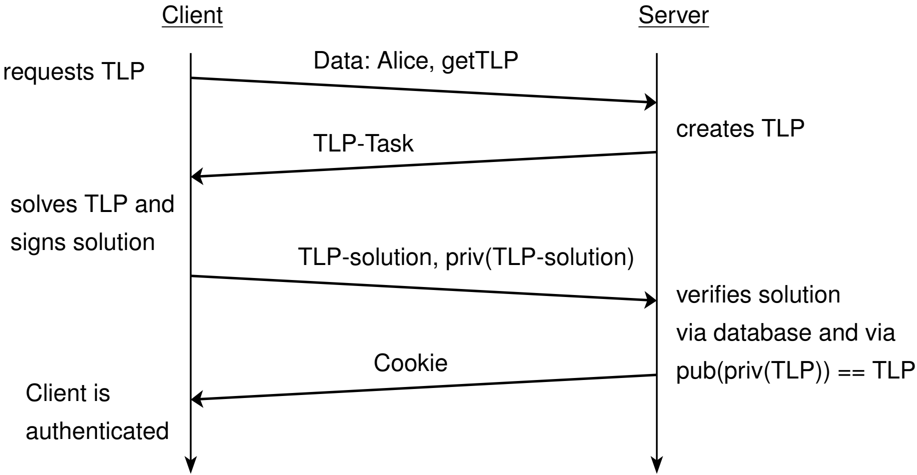

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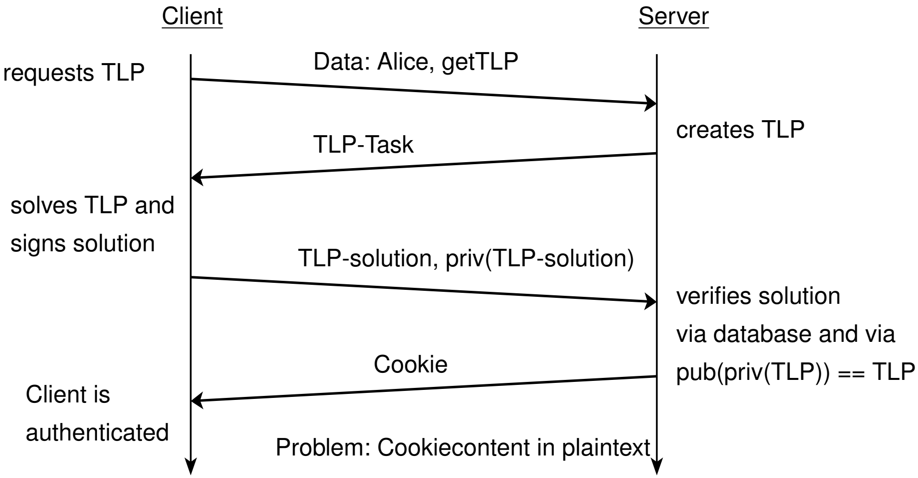

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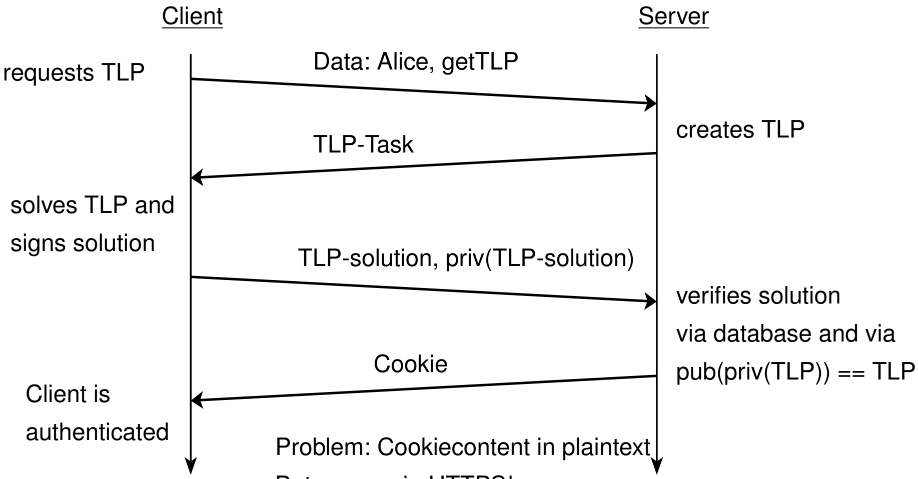
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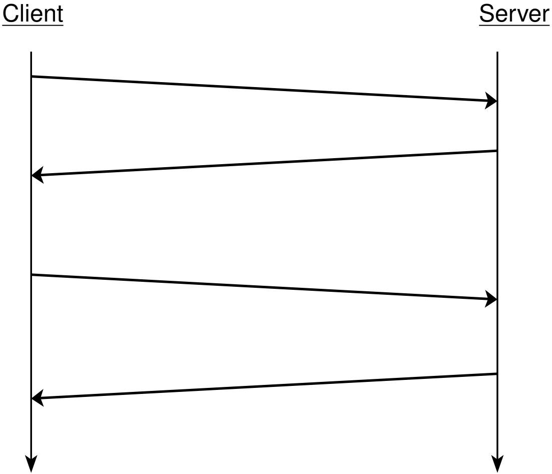
But: secure in HTTPS!

PKWL 3.0 - Encrypted Cookies



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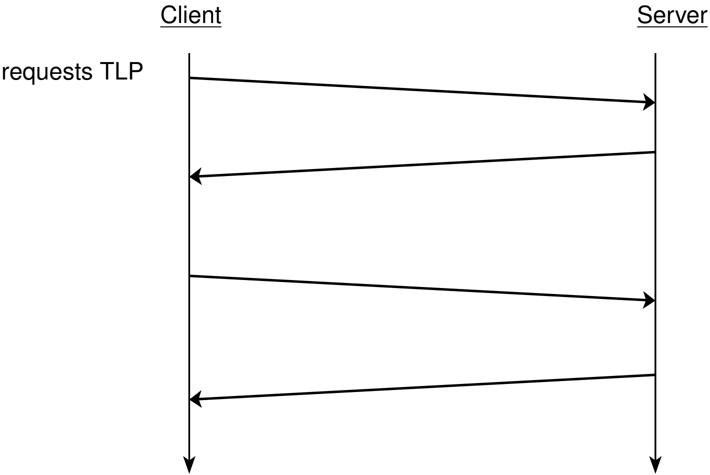

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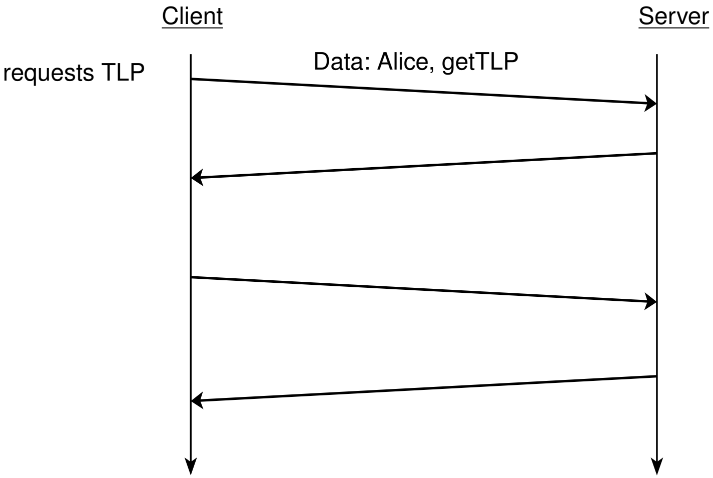

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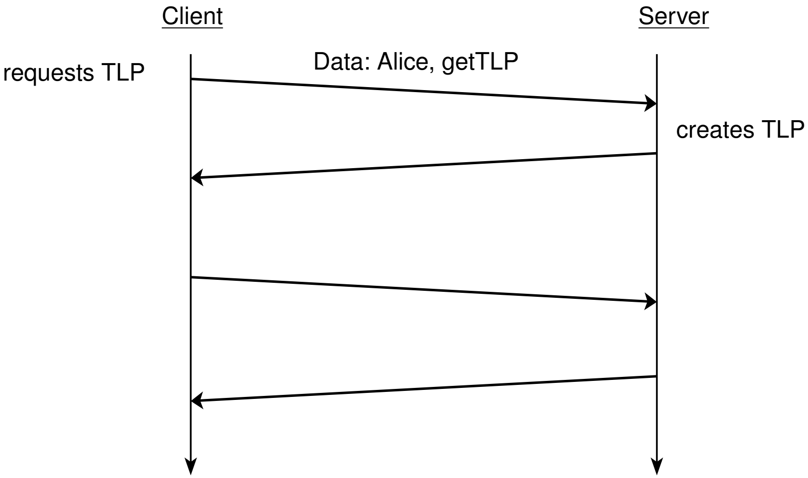

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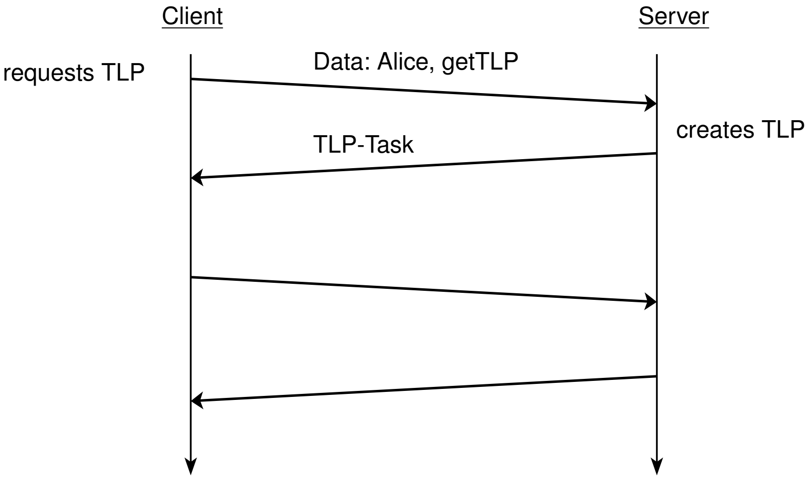

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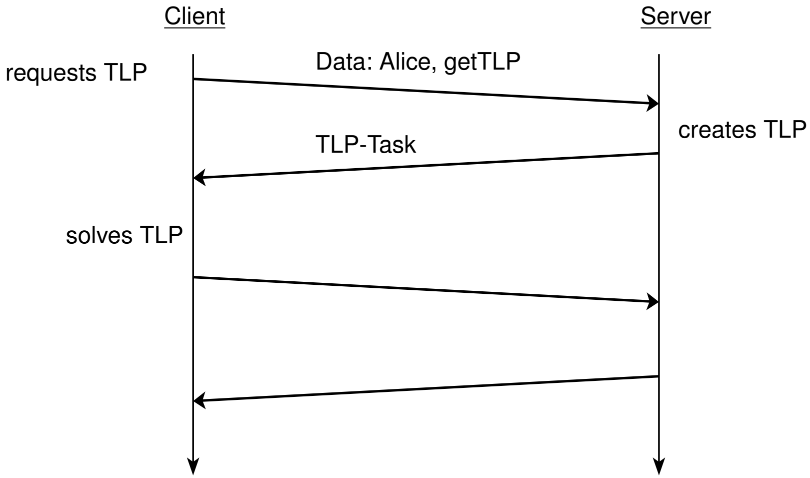

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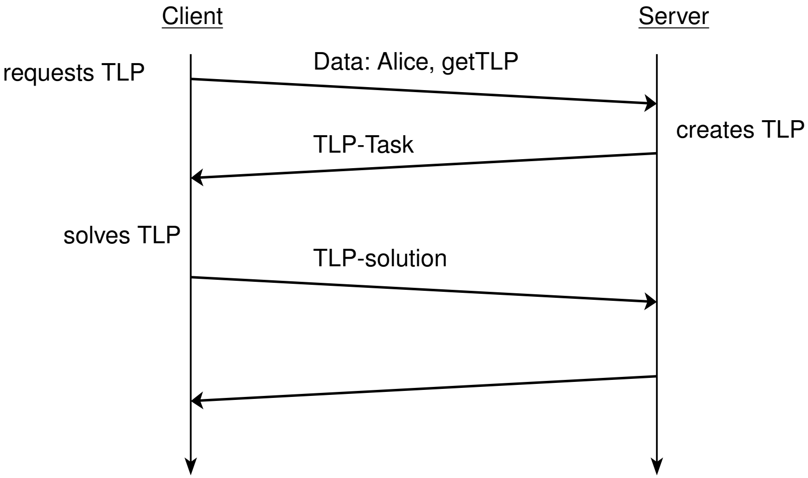

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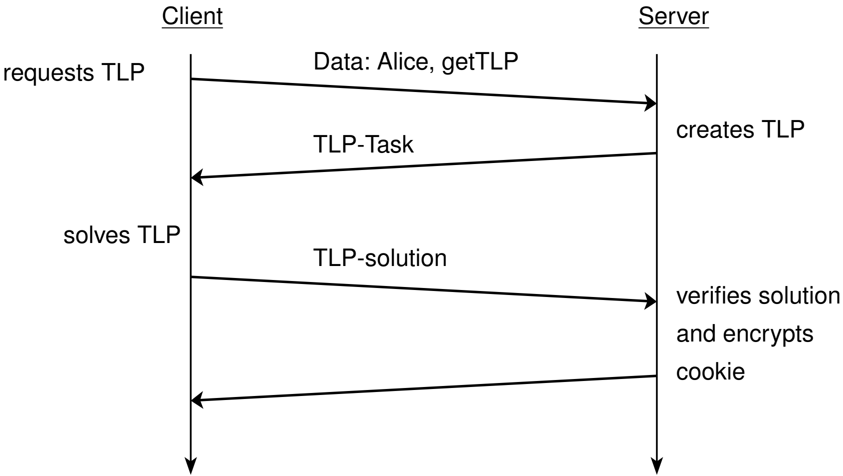

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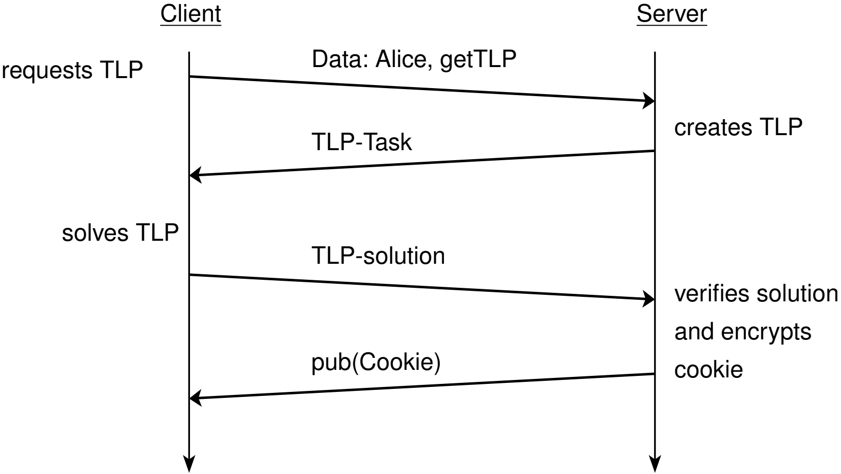

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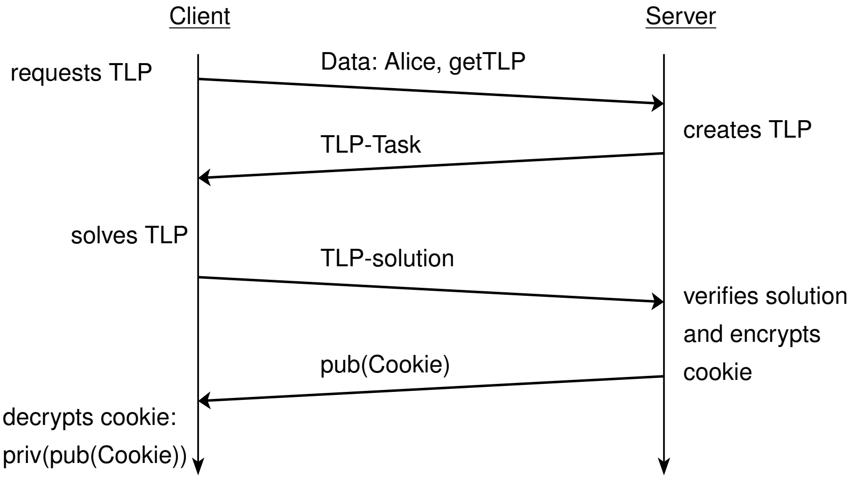

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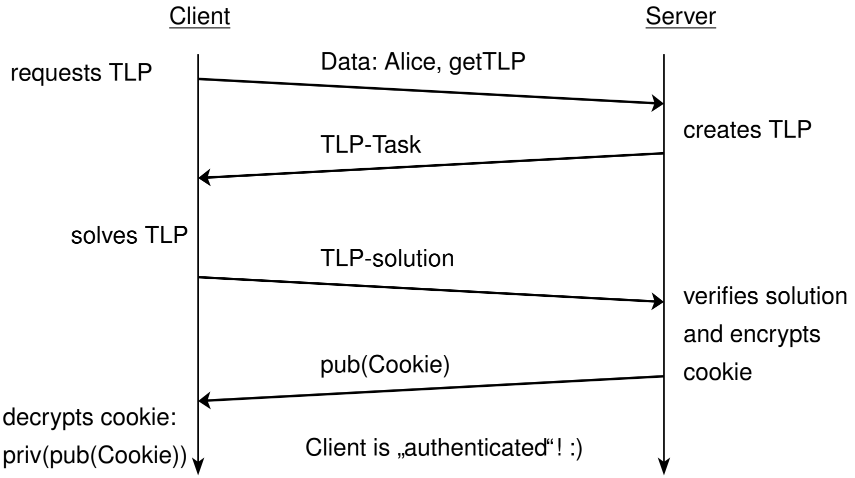

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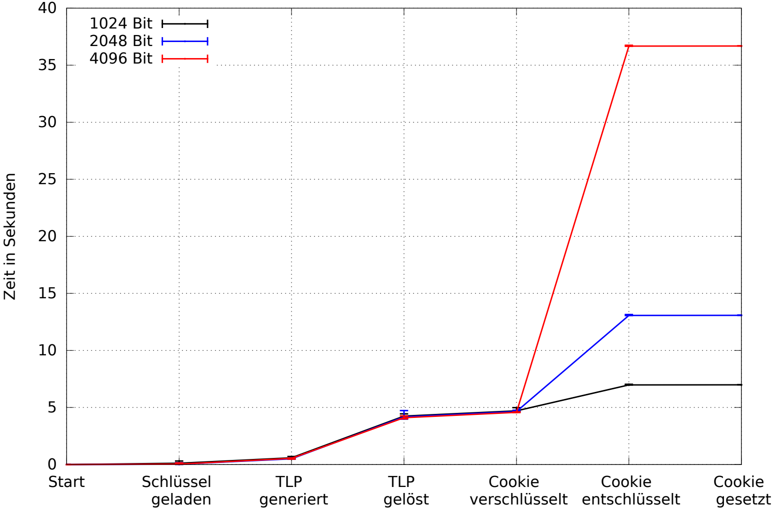
pub(Cookie)

decrypts cookie: priv(pub(Cookie))

Client is „authenticated“! :)

Demo

Evaluation


40
35
30
25
20
15
10
5
0
Zeit in Sekunden
1024 Bit
2048 Bit
4096 Bit
Start
Schlüssel geladen
TLP generiert
TLP gelöst
Cookie verschlüsselt
Cookie entschlüsselt
Cookie gesetzt

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  - Proof-of-Work-System
  - RSA-Cryptosystem

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- Performance
  - 2048 Bit-Keylength - ca. 13 seconds

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  - RSA-Cryptosystem
- Performance
  - 2048 Bit-Keylength - ca. 13 seconds
- Comfort
  - no configuration on server- and client-side
  - complete control via graphical user interface
  - daily routine: two mouse clicks for authentication

Conclusion

- Passwords are a thing of the past

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  - automatic authentication in the background

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- Future Work
  - dynamic time-adjustment of the Proof-of-Work-Systems
  - automatic authentication in the background
  - W3C plans a Web Cryptography API

Questions?

- Source-Code: `https://github.com/mirkoole/PKWL`