Encryption

Public keys and SSL

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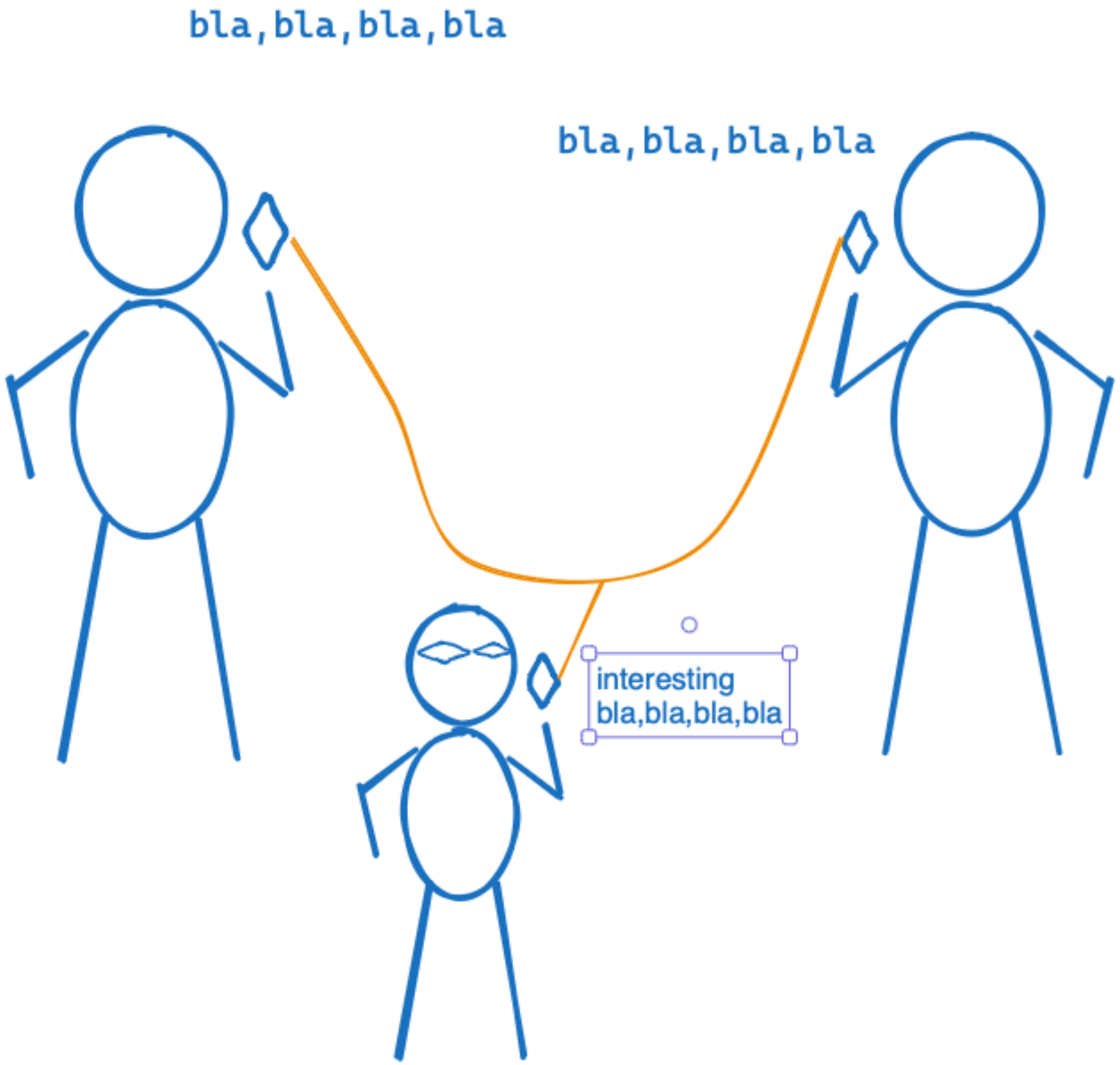
What SSL?

- A protocol to ensure the link between server and client is secure and the content hidden from a third party. Message on WhatsApp for i.e. are encrypted point-to-point

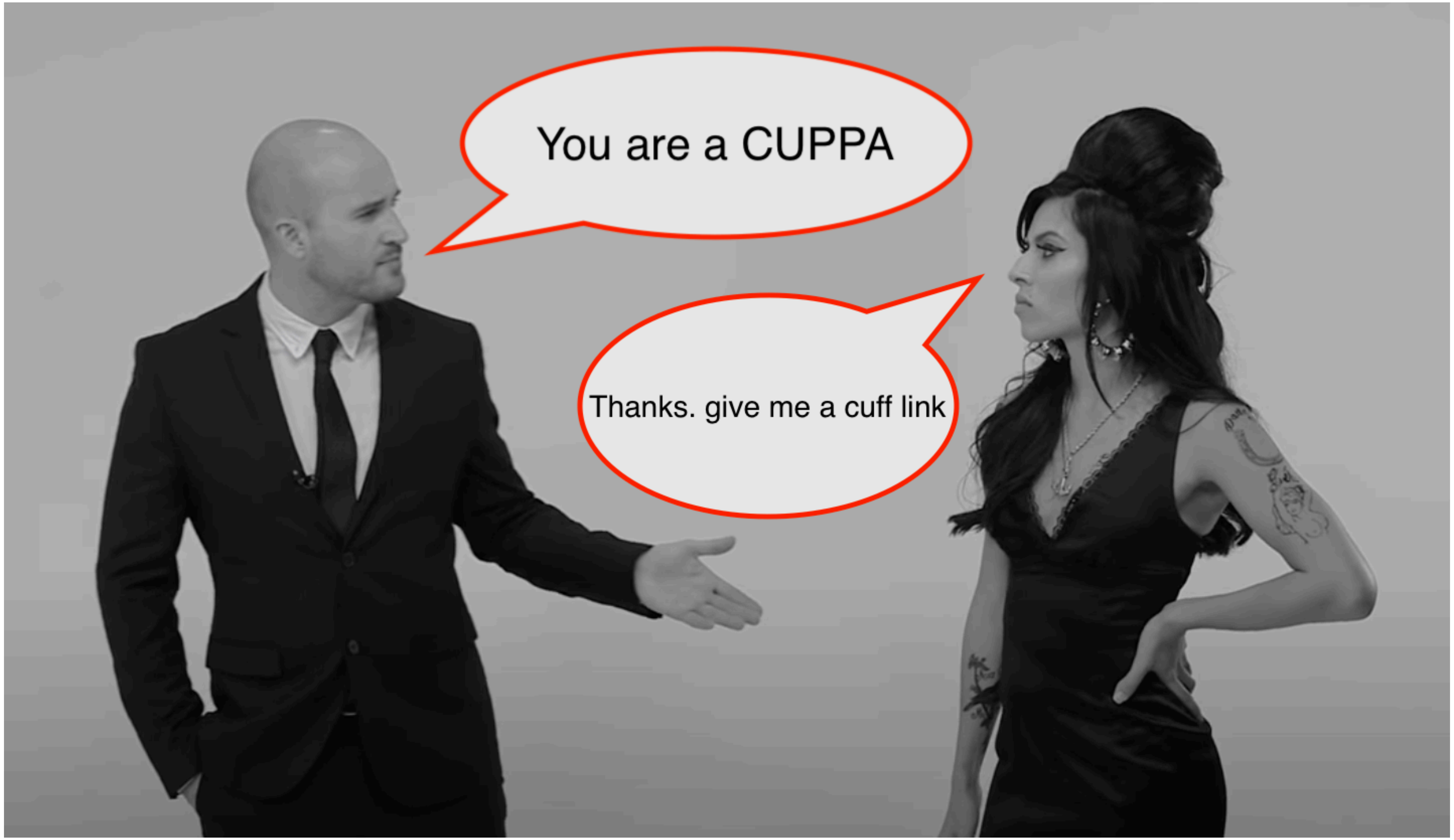
The problem to solve when sending and receiving message:

- Imaging you need to pay a contractor or book a room in advance over the phone. Would you communicate your card details knowing anyone with malicious intentions can tap in your phone or internet and steal your money?

- Back on time there was no way to hide the message.
- The conversation between 2 persons talking over the phone could have been easily intercepted.

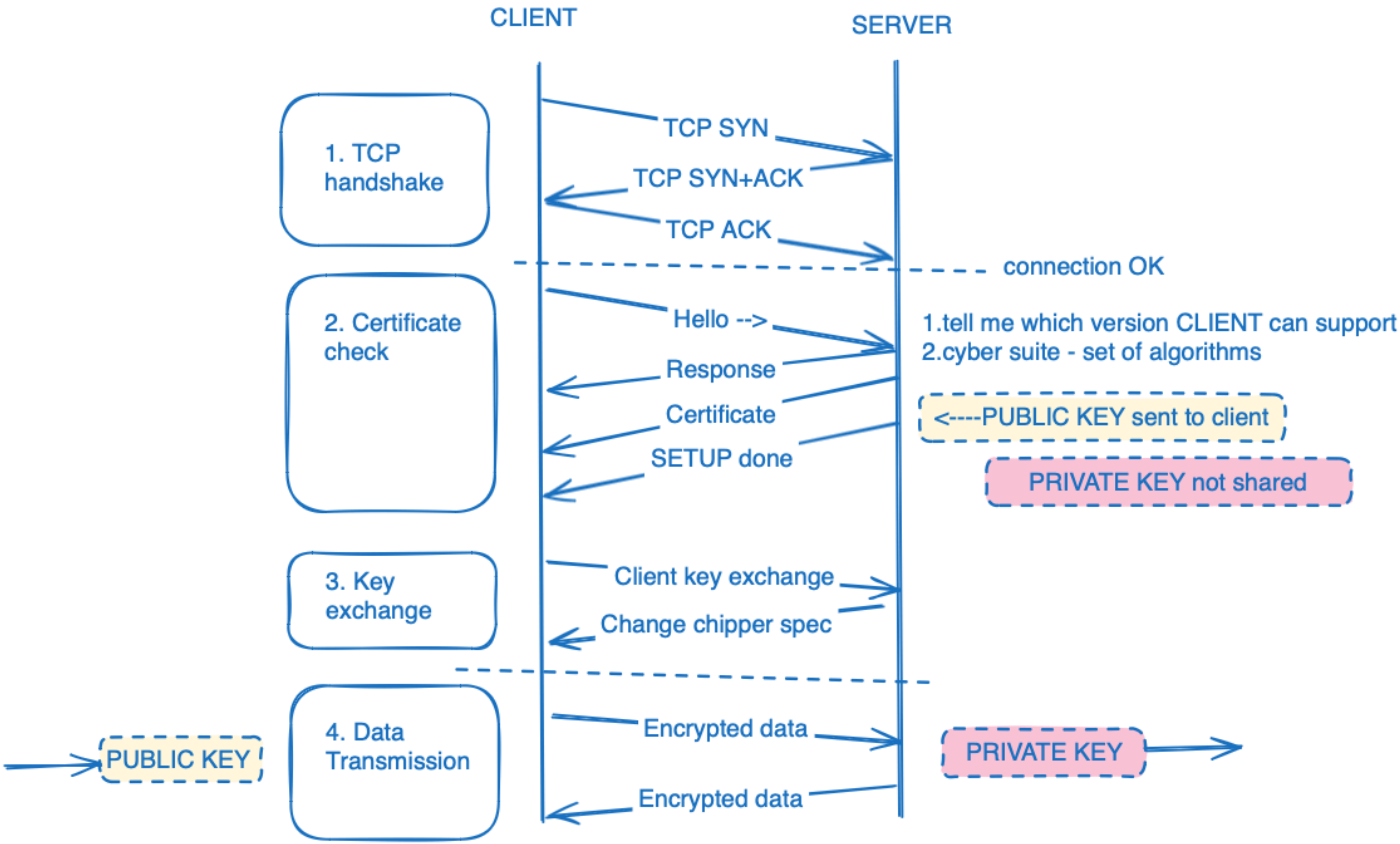


Solution: use a code



Whattt??

- Good but unless you want learn a slang and agree in advance….
- Solution for internet come with SSL.
- Encryption works as a mask which alter the real value of the real message. Think about a mask in photoshop where a bitmap layer is injected to overlap an image to alter the original colours.
- SSL use an asymmetric + Symmetric cryptography
- TLS improved the SSL security
- HTTPS is an extension of the HTTP protocol



CLIENT

SERVER

1. TCP handshake

TCP SYN

TCP SYN+ACK

TCP ACK

connection OK

2. Certificate check

Hello -->

1.tell me which version CLIENT can support
2.cyber suite - set of algorithms

Response

Certificate

<----PUBLIC KEY sent to client

SETUP done

PRIVATE KEY not shared

3. Key exchange

Client key exchange

Change chipper spec

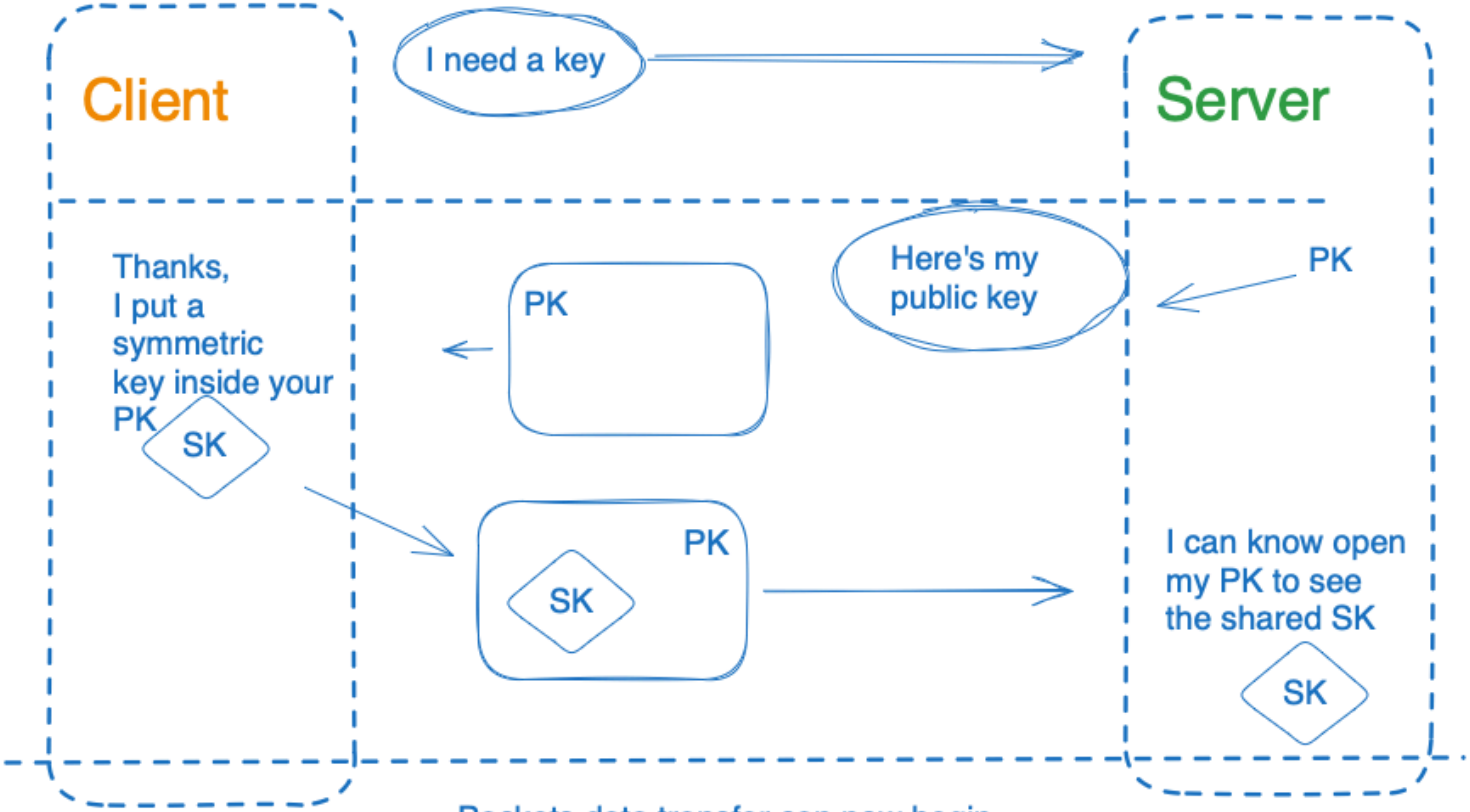
4. Data Transmission

PUBLIC KEY

Encrypted data

PRIVATE KEY

Encrypted data



I need a key

Here's my public key

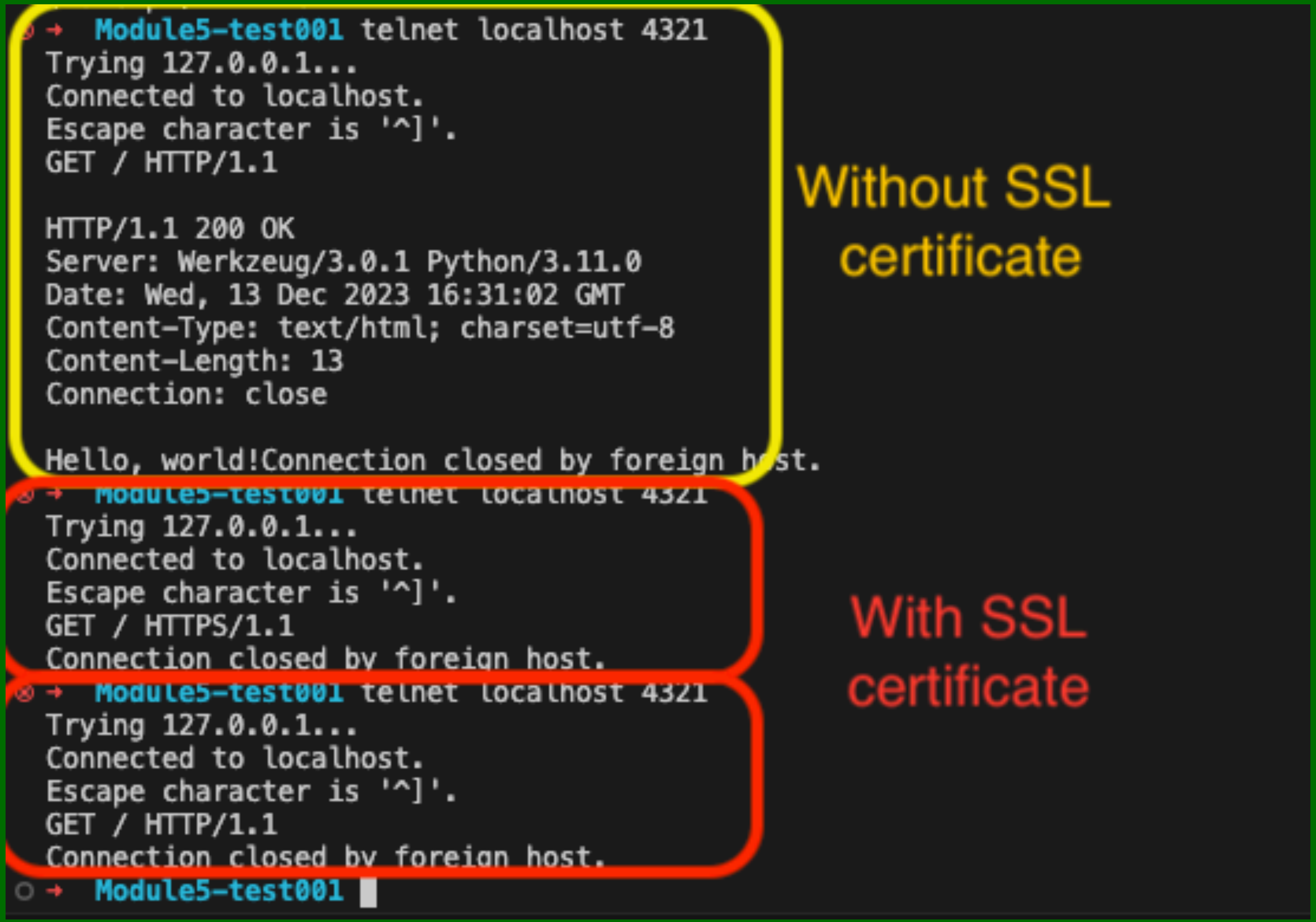
Thanks, I put a symmetric key inside your PK

I can know open my PK to see the shared SK

Packets data transfer can now begin

Running the server on localhost

- It seems TELNET is not granted access when running _flask + SSL_
- Not sure at this stage?!?



```
→  Module5-test001 telnet localhost 4321
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
GET / HTTP/1.1

HTTP/1.1 200 OK
Server: Werkzeug/3.0.1 Python/3.11.0
Date: Wed, 13 Dec 2023 16:31:02 GMT
Content-Type: text/html; charset=utf-8
Content-Length: 13
Connection: close

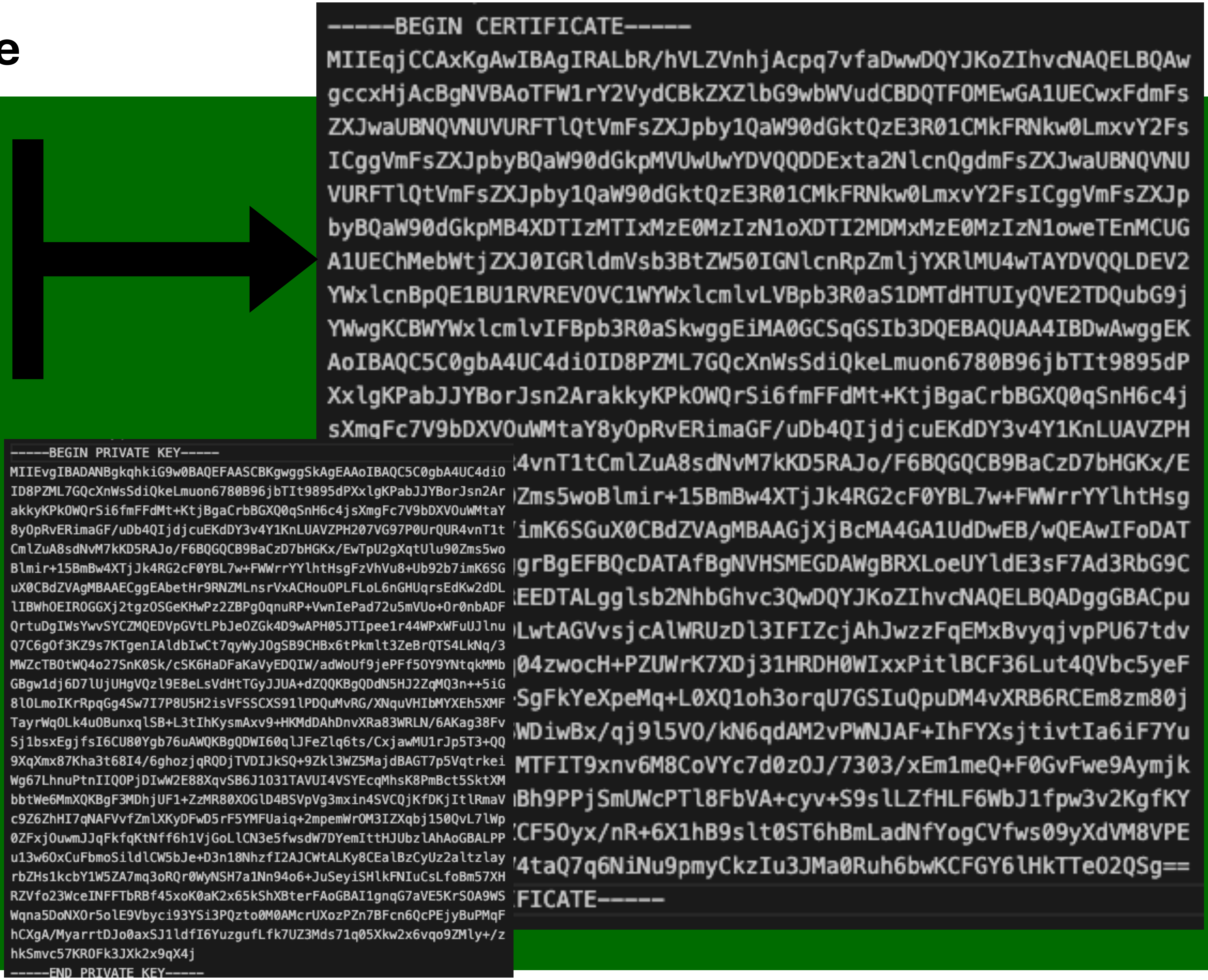
Hello, world!Connection closed by foreign host.
⊗ →  Module5-test001 telnet localhost 4321
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
GET / HTTPS/1.1
Connection closed by foreign host.
⊗ →  Module5-test001 telnet localhost 4321
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
GET / HTTP/1.1
Connection closed by foreign host.
○ →  Module5-test001
```

Without SSL certificate

With SSL certificate

SSL certificate

- Server public’s key
- Server info
- Dig signature



```
------BEGIN CERTIFICATE------
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ZXJwaUBNQVNUVURFTlQtVmFsZXJpby1QaW90dGktQzE3R01CMkFRNkw0LmxvY2Fs
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imK6SGuX0CBdZVAgMBAAGjXjBcMA4GA1UdDwEB/wQEAwIFoDAT
grBgEFBQcDATAfBgNVHSMEGDAWgBRXLoeUYldE3sF7Ad3RbG9C
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CF5Oyx/nR+6X1hB9slt0ST6hBmLadNfYogCVfws09yXdVM8VPE
4taQ7q6NiNu9pmyCkzIu3JMa0Ruh6bwKCFGY6lHkTTeO2QSg==
FICATE------
```

Private Key

```
-----BEGIN PRIVATE KEY-----
MIIEvgIBADANBgkqhkiG9w0BAQEFAASCBKgwggSkAgEAAoIBAQC5C0gbA4UC4diO
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c9Z6ZhHI7qNAFVvfZmlXKyDFwD5rF5YMFUaiq+2mpemWrOM3IZXqbj150QvL7lWp
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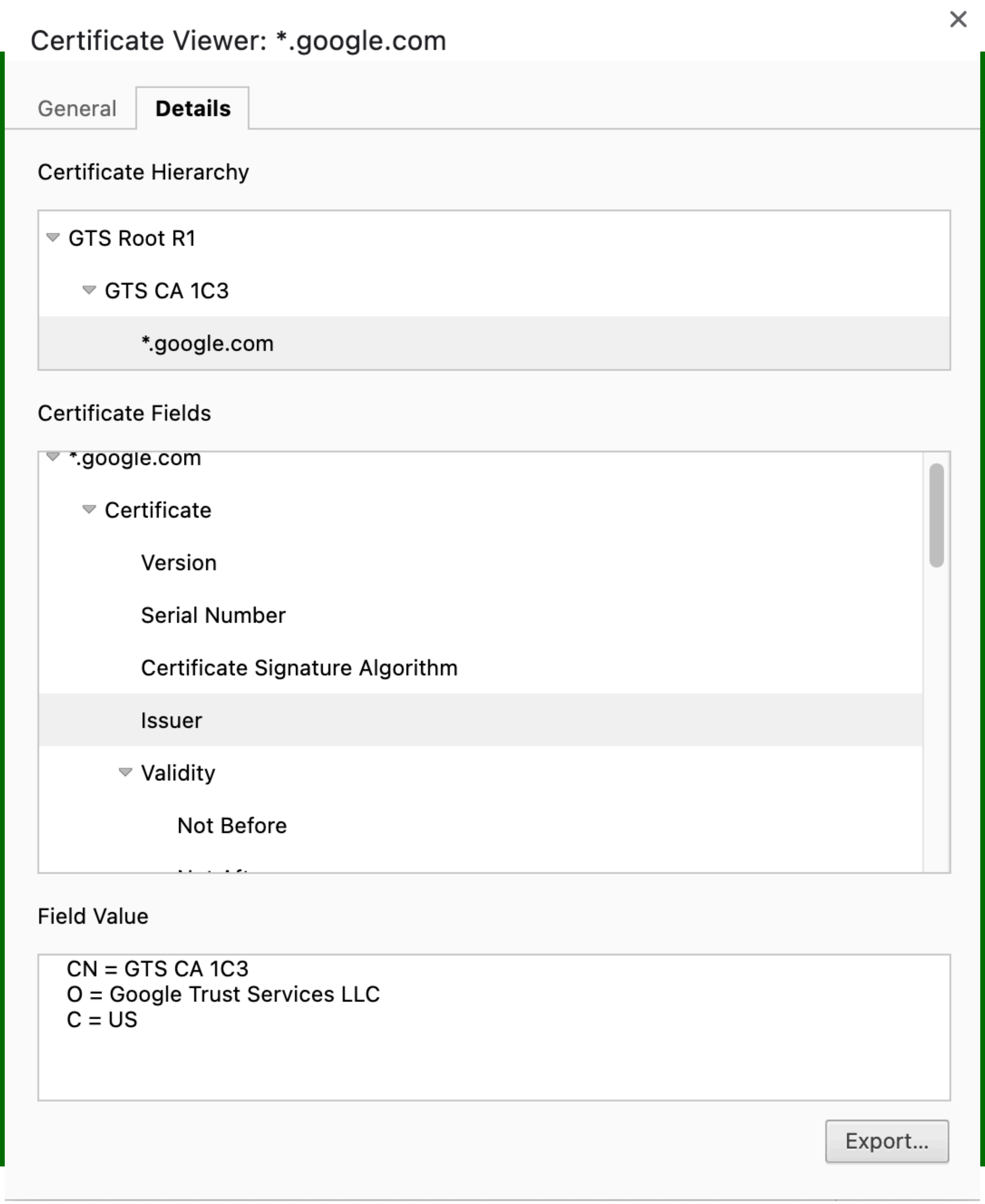
hkSmvc57KROFk3JXk2x9qX4j
-----END PRIVATE KEY-----
```

- Check the certificate
- if a website look suspicious



Certificate Viewer: *.google.com

Certificate Hierarchy

- GTS Root R1
  - GTS CA 1C3
    - *.google.com

Certificate Fields

- *.google.com
  - Certificate
    - Version
    - Serial Number
    - Certificate Signature Algorithm
    - Issuer
    - Validity
      - Not Before

Field Value

```
CN = GTS CA 1C3
O = Google Trust Services LLC
C = US
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END