EBERHARD KARLS UNIVERSITÄT TÜBINGEN

FACULTY OF SCIENCE
Communication Networks

End-to-End User Authentication with OpenID Connect: Use Cases and Benefits

by Jonas Primbs, Chair of Communication Networks, Faculty of Science, University of Tübingen, Germany

in /in/jonasprimbs

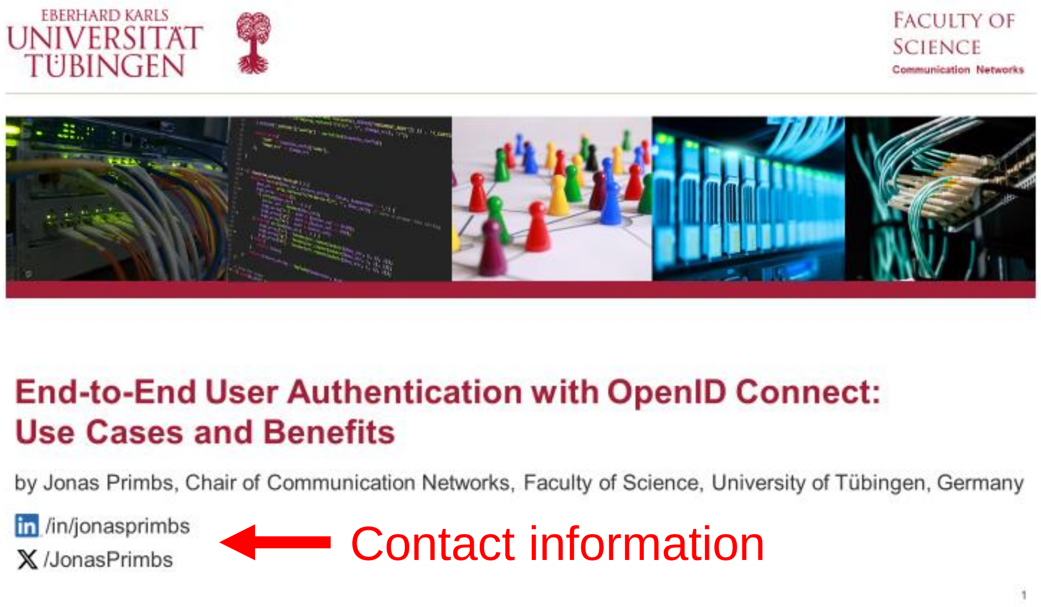
𝕏 /JonasPrimbs

http://kn.inf.uni-tuebingen.de

Introduction

- Assume a follow-up email conversation with me:
  - How can you be sure that this is really me?

- Remember contact info from first slide:



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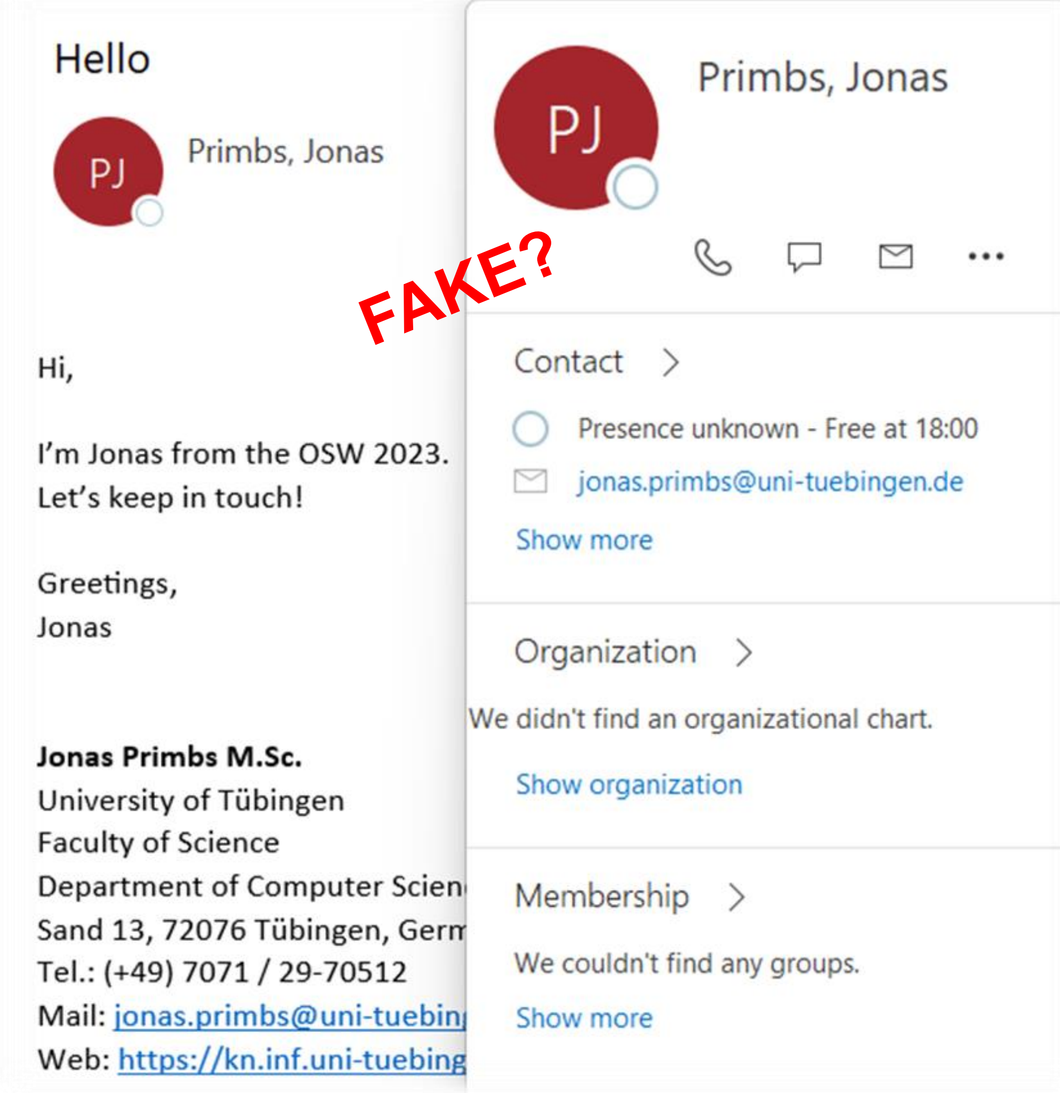
in /in/jonasprimbs
X /JonasPrimbs

1

Contact information

- Goal: use OIDC accounts for end-to-end authentication



Hello

Primbs, Jonas

Hi,

I'm Jonas from the OSW 2023.
Let's keep in touch!

Greetings,
Jonas

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Faculty of Science
Department of Computer Scien
Sand 13, 72076 Tübingen, Germ
Tel.: (+49) 7071 / 29-70512
Mail: jonas.primbs@uni-tuebin
Web: https://kn.inf.uni-tuebing

FAKE?

Primbs, Jonas

Contact >

○ Presence unknown - Free at 18:00

✉ jonas.primbs@uni-tuebingen.de

Show more

Organization >

We didn't find an organizational chart.

Show organization

Membership >

We couldn't find any groups.

Show more

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Message Layer Authentication with OpenID Connect

by Jonas Primbs, Chair of Communication Networks, Faculty of Science, University of Tübingen, Germany

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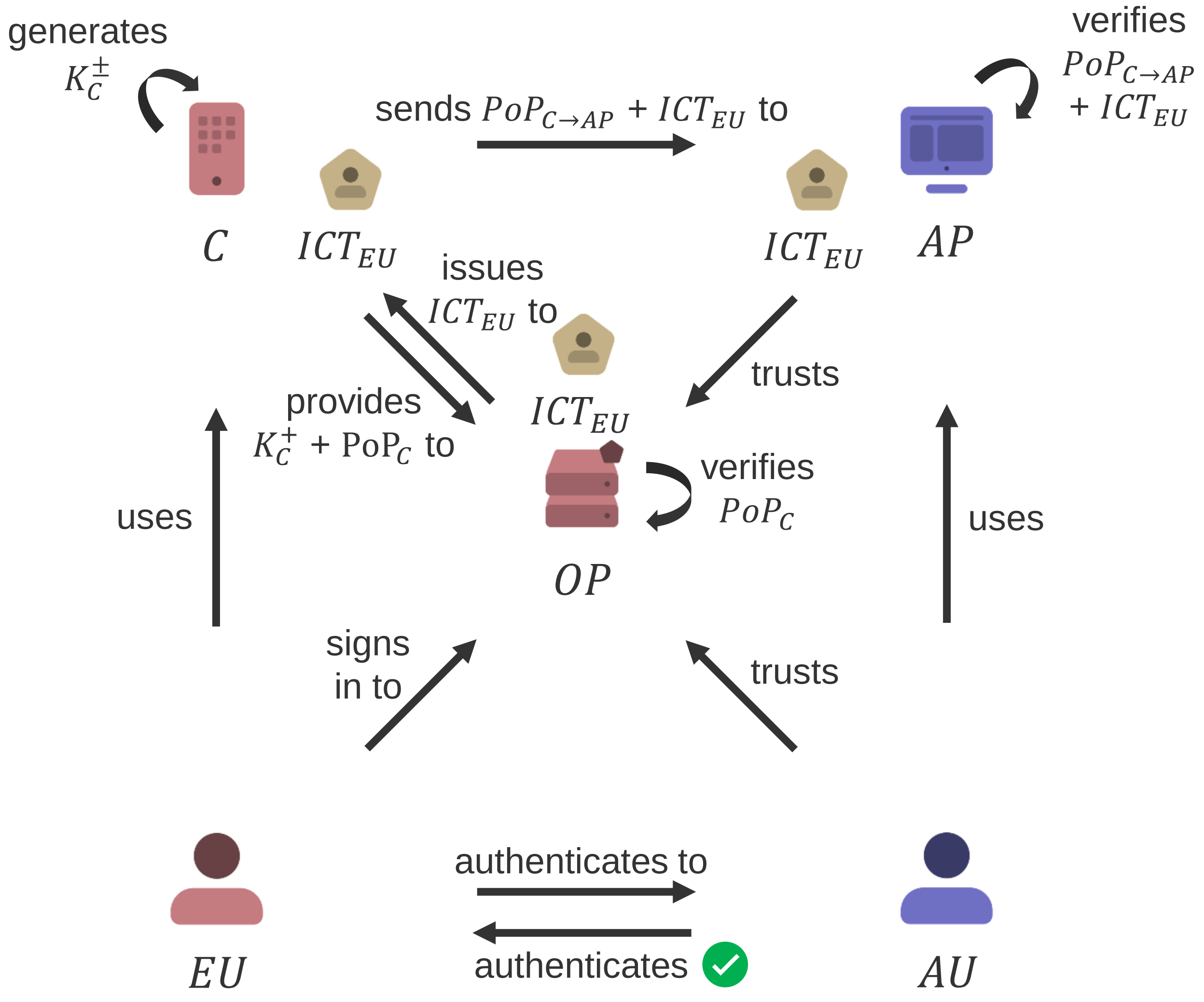
OAuth Security Workshop 2022

Trondheim, Norway

Recap + Update: Terminology



generates $K_C^{\pm}$

C

ICT_{EU}

sends $PoP_{C\rightarrow AP}$ + ICT_{EU} to

ICT_{EU}

AP

verifies $PoP_{C\rightarrow AP}$ + ICT_{EU}

issues ICT_{EU} to

ICT_{EU}

trusts

provides K_C^+ + PoP_C to

uses

verifies PoP_C

OP

uses

signs in to

trusts

EU

authenticates to

authenticates ✓

AU

End User (EU)
Resource Owner / real person

Client (C)
Client application of the EU

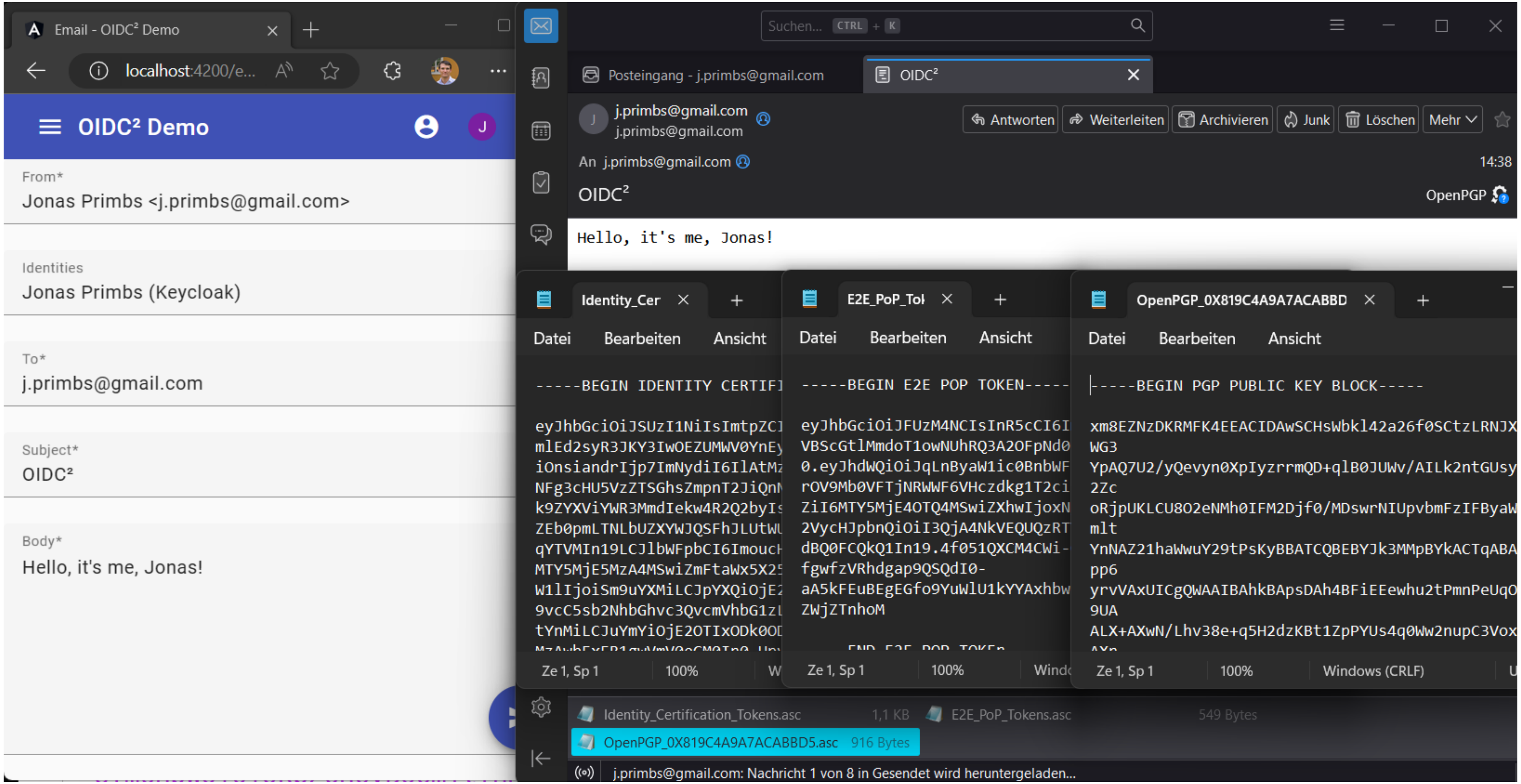
OpenID Provider (OP)
Identity Provider of the EU

Identity Certification Token (ICT)
JWT with identity claims of EU + public key of C (K_C^+), signed by OP, if proof of possession for K_C^- (PoP_C) is valid

Authenticating User (AU)
User who authenticates the EU

Authenticating Party (AP)
Client application of the AU

Prototype!



From*
Jonas Primbs <j.primbs@gmail.com>

Identities
Jonas Primbs (Keycloak)

To*
j.primbs@gmail.com

Subject*
OIDC²

Body*
Hello, it's me, Jonas!

j.primbs@gmail.com
j.primbs@gmail.com
An j.primbs@gmail.com
14:38
OIDC²

Hello, it's me, Jonas!

```
-----BEGIN IDENTITY CERTIFI

eyJhbGciOiJSUzI1NiIsImtpZCI
mlEd2syR3JKY3IwOEZUMWV0YnEy
iOnsiandrIjp7ImNydiI6IlAtMz
NFg3cHU5VzZTSGhsZmpnT2JiQnN
k9ZYXViYWR3MmdIekw4R2Q2byIs
ZEb0pmLTNLbUZXYWJQSFhJLUtWU
qYTVMIn19LCJlbWFpbCI6ImoucH
MTY5MjE5MzA4MSwiZmFtaWx5X25
W1lIjoiSm9uYXMiLCJpYXQiOjE2
9vcC5sb2NhbGhvc3QvcmVhbG1zL
tYnMiLCJuYmYiOjE2OTIxODk0OD
```

```
-----BEGIN E2E POP TOKEN-----

eyJhbGciOiJFUzM4NCIsInR5cCI6I
VBScGtlMmdoT1owNUhRQ3A2OFpNd0
0.eyJhdWQiOiJqLnByaW1ic0BnbWF
rOV9Mb0VFTjNRWWF6VHczdkg1T2ci
ZiI6MTY5MjE4OTQ4MSwiZXhwIjoxN
2VycHJpbnQiOiI3QjA4NkVEQUQzRT
dBQ0FCQkQ1In19.4f051QXCM4CWi-
fgwfzVRhdgap9QSQdI0-
aA5kFEuBEgEGfo9YuWlU1kYYAxhbw
ZWjZTnhoM
```

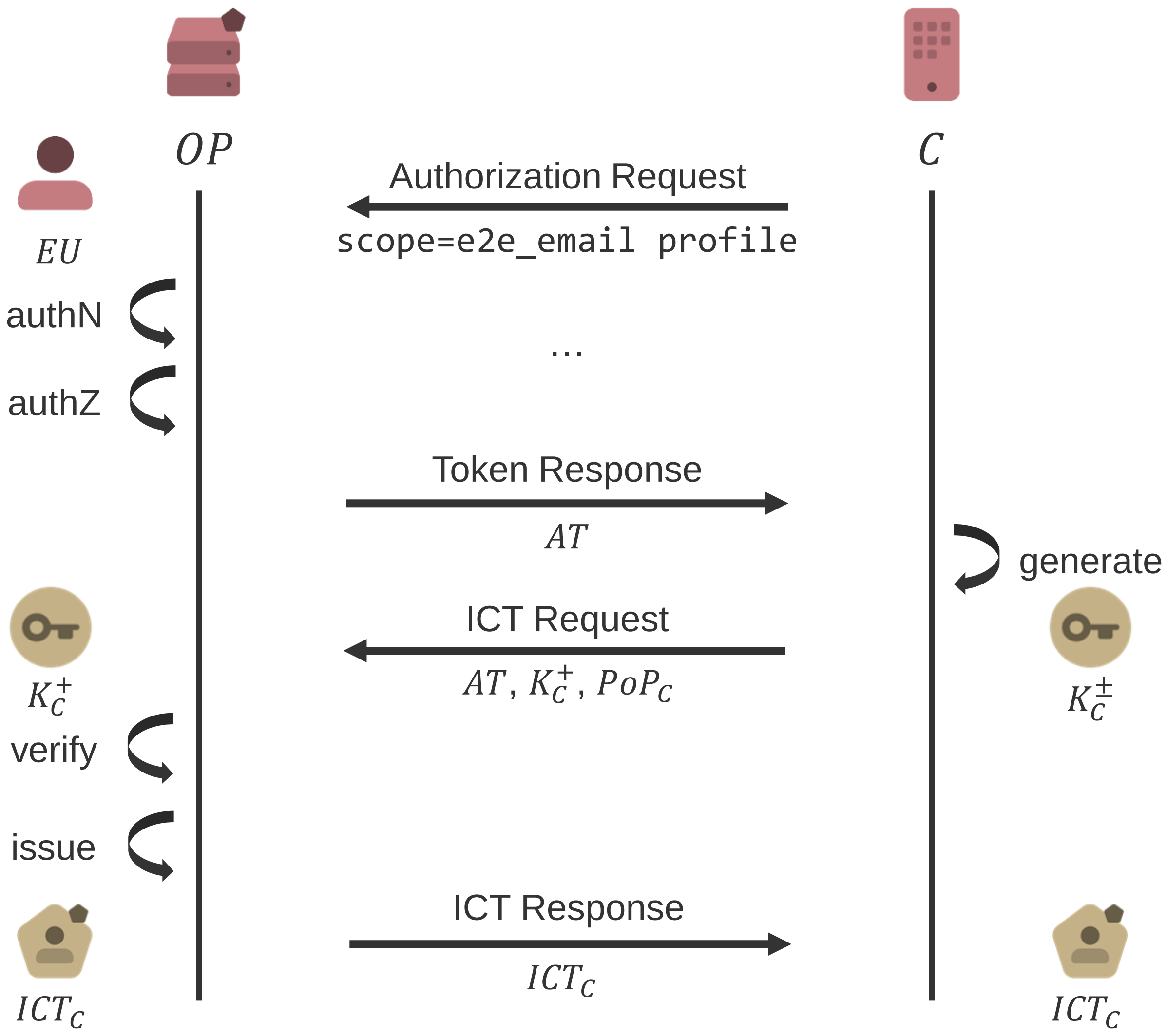
```
-----BEGIN PGP PUBLIC KEY BLOCK-----

xm8EZNzDKRMFK4EEACIDAwSCHsWbkl42a26f0SCtzLRNJX
WG3
YpAQ7U2/yQevyn0XpIyzrrmQD+qlB0JUWv/AILk2ntGUsy
2Zc
oRjpUKLCU8O2eNMh0IFM2Djf0/MDswrNIUpvbmFzIFByaW
mlt
YnNAZ21haWwuY29tPsKyBBATCQBEBYJk3MMpBYkACTqABA
pp6
yrvVAxUICgQWAAIBAhkBApsDAh4BFiEEwhu2tPmnPeUqO
9UA
ALX+AXwN/Lhv38e+q5H2dzKBt1ZpPYUs4q0Ww2nupC3Vox
```

Identity_Certification_Tokens.asc 1,1 KB
E2E_PoP_Tokens.asc 549 Bytes
OpenPGP_0X819C4A9A7ACABBD5.asc 916 Bytes

j.primbs@gmail.com: Nachricht 1 von 8 in Gesendet wird heruntergeladen...

Recap + Update: Obtain an ICT

1. C sends OAuth 2 Authorization Request to OP
   - Contains scope request for end-to-end context (`e2e_email`) and profile information (`profile`)
2. EU authenticates to OP and authorizes requested scopes
3. OP responds with Access Token (AT) in Token Response
   - AT authorizes for granted scopes
4. C generates asymmetric key pair $K_C^{\pm}$
5. C sends ICT Request to OP
   - Contains public key AT, K_C^+, and PoP of K_C^-
6. OP verifies ICT Request
   - Requires verification of AT and PoP
7. RP issues ICT in ICT Response

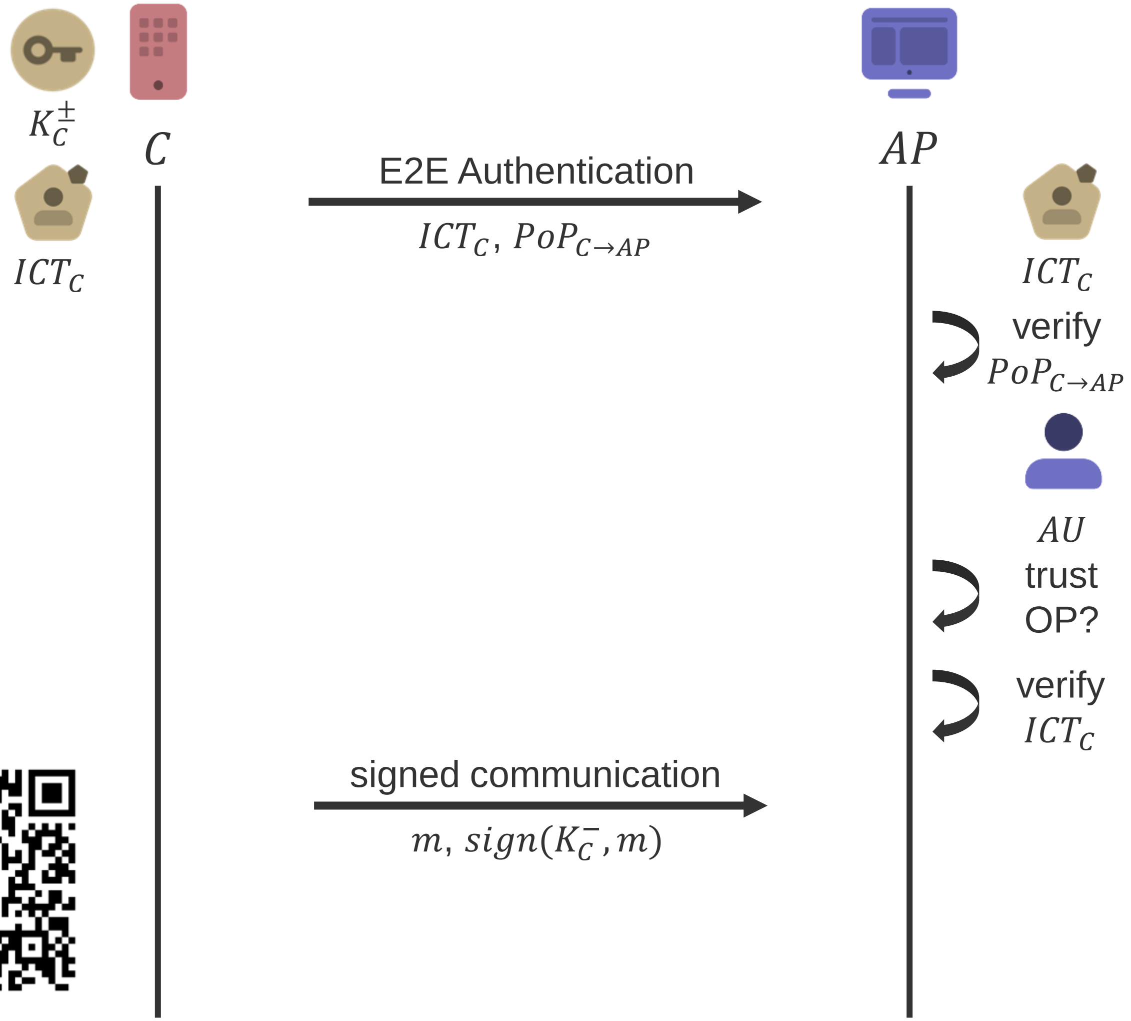


Recap + Update: Use an ICT

1. C sends E2E Authentication message to AP
   - Contains ICT and a new PoP for the AP
2. AP verifies ICT and PoP
   - PoP valid for ICT's K_C^+?
   - Does the AU trust the OP?
   - ICT valid?

- ► Continue with signed communication
  - Using trusted K_C^- as signing key
- ► We call it "**Open Identity Certification for OIDC**"
  - Aka **OIDC²**
- ► Draft is on GitHub!
  - Pull requests and discussions are welcome!

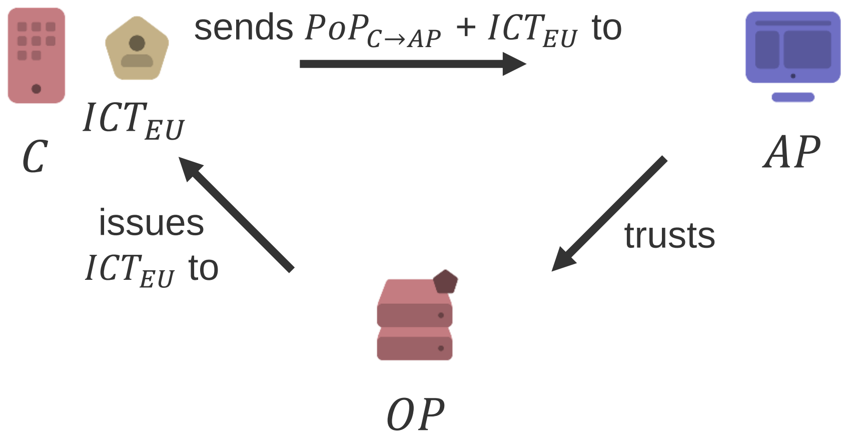
https://bit.ly/oidc2



OIDC^2 vs. SSI

OIDC^2

- Trust relationship:



sends $PoP_{C \to AP}$ + ICT_{EU} to

C

ICT_{EU}

AP

issues ICT_{EU} to

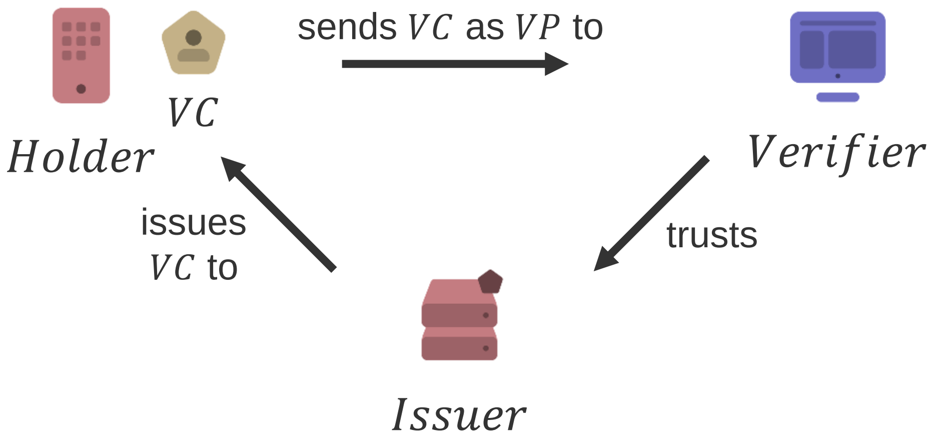
trusts

OP

- ICT attests identity claims of EU
- C authenticates with PoP + ICT to AP
- Requires deployed OIDC infrastructure
- Key pair and ICT are **short-lived**
- **No** key revocation mechanism required

SSI

- Trust relationship:



sends VC as VP to

$Holder$

VC

$Verifier$

issues VC to

trusts

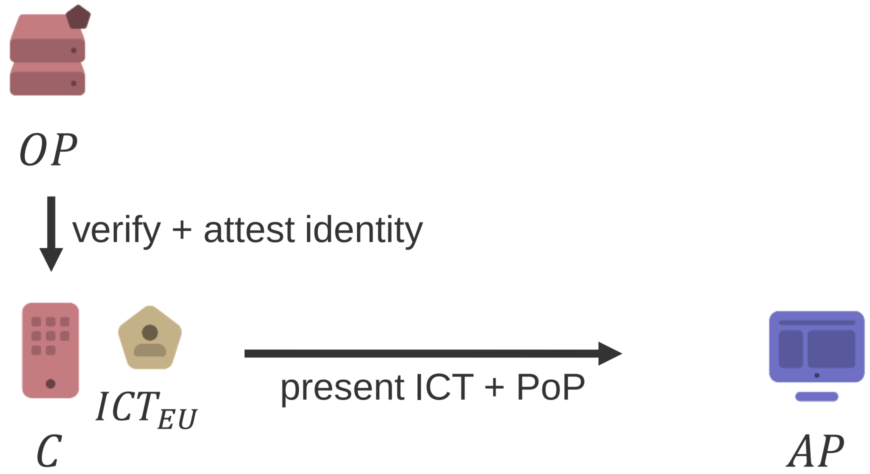
$Issuer$

- VC attests claims of Holder
- Holder authenticates with VP to Verifier
- Requires deployed SSI infrastructure
- Key pair and VC are **long-lived**
- Key revocation requires verification

OIDC² vs. PKI

OIDC²

- Trust relationship:



OP

verify + attest identity

C ICT_{EU}

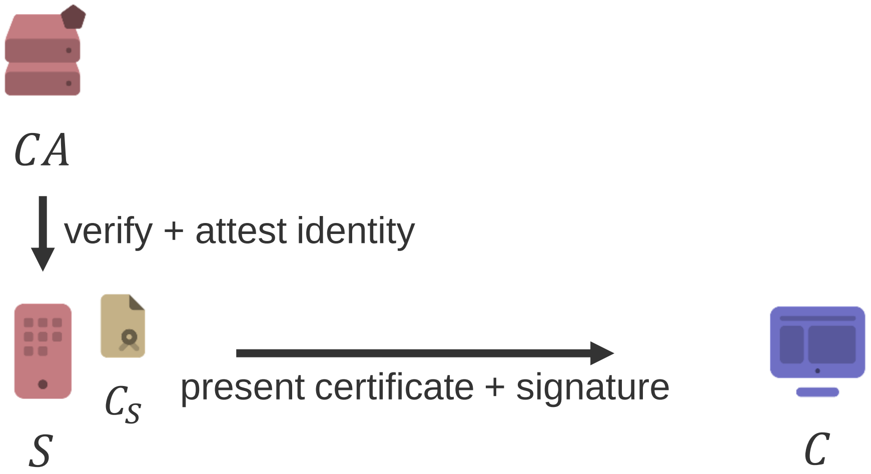
present ICT + PoP

AP

- AP must trust OP
- EU signs into OP; C proves possession of K_C^- to obtain an ICT
- AP authenticates C by ICT and PoP
- **No** key revocation mechanism required

PKI

- Trust relationship:



CA

verify + attest identity

S C_S

present certificate + signature

C

- Client (C) must trust Certificate Authority (CA)
- Service (S) performs ACME challenge to obtain an X.509 certificate
- C authenticates S by certificate and signature
- Key revocation requires verification

When (not) to use OIDC^2?

Do!

- Users authenticate themselves end-to-end
  - Intermediate services are not trusted
- Users identify each other with OIDC accounts
  - Or claims the OP is an authority for
- Users authenticate themselves only online
  - ICTs are requested on demand

Don’t!

- Users authenticate to intermediate services
  - Use normal OIDC instead
- Users identify each other via attributes
  - Requires attestation by authority (CA or Issuer)
- Users may authenticate themselves offline
  - Requires long-lived certificates or VCs

Outlook

- Next steps:
  - Prototype for instant messaging with Matrix
  - Prototype for video conferencing with WebRTC
  - Further improve OpenID Draft

https://bit.ly/oidc2

- Suggestions welcome!
  - Feel free to open discussions on GitHub
- Participation welcome!
  - Feel free to send a pull request on GitHub

- Want to stay in touch?
  - Here are my OIDC profiles:

    in /in/jonasprimbs

    X /JonasPrimbs

  - Or mail to: jonas.primbs@uni-tuebingen.de

Thank you!