Attested TLS

draft-bft-rats-kat

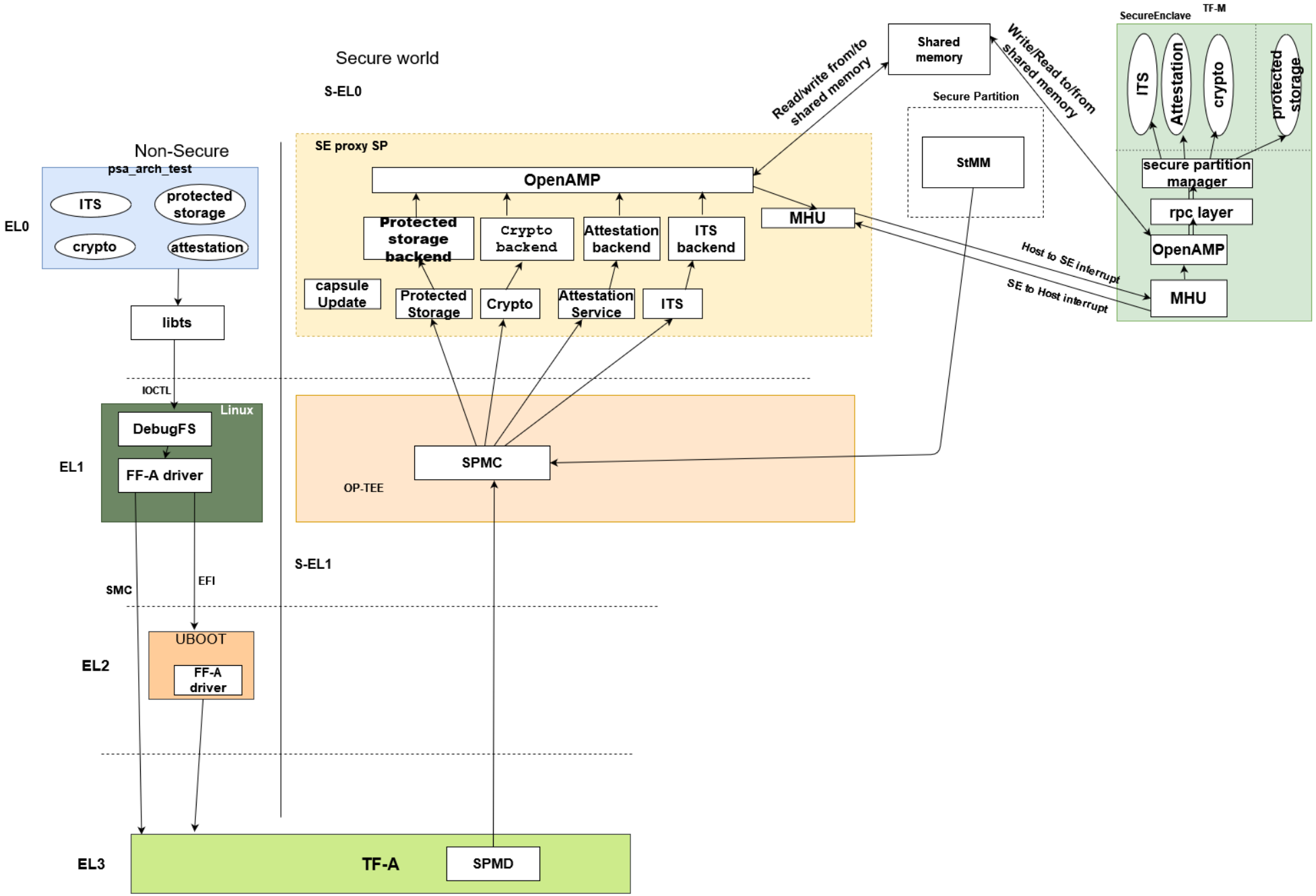
draft-fossati-tls-attestation

draft-ftbs-rats-msg-wrap

Initial Attestation

- Bootloader creates a hash over the software (bootloaders, firmware, etc).
- Passes this software measurement up to the attestation service.
- This measurement will, if requested, be exposed in a PAT – Platform Attestation Token.
- PAT can be used to determine whether the software on the device has been modified.

Reality


Secure world
S-EL0
Non-Secure
psa_arch_test
ITS
protected storage
crypto
attestation
EL0
libts
IOCTL
Linux
DebugFS
FF-A driver
EL1
SMC
EFI
UBOOT
FF-A driver
EL2
EL3
TF-A
SPMD
S-EL1
SE proxy SP
OpenAMP
Protected storage backend
Crypto backend
Attestation backend
ITS backend
MHU
capsule Update
Protected Storage
Crypto
Attestation Service
ITS
SPMC
OP-TEE
Shared memory
Read/write from/to shared memory
Write/Read to/from shared memory
Secure Partition
StMM
Host to SE interrupt
SE to Host interrupt
SecureEnclave
TF-M
ITS
Attestation
crypto
protected storage
secure partition manager
rpc layer
OpenAMP
MHU

Attestation in IoT Device Onboarding

- IoT device wants to onboard to a device management infrastructure.

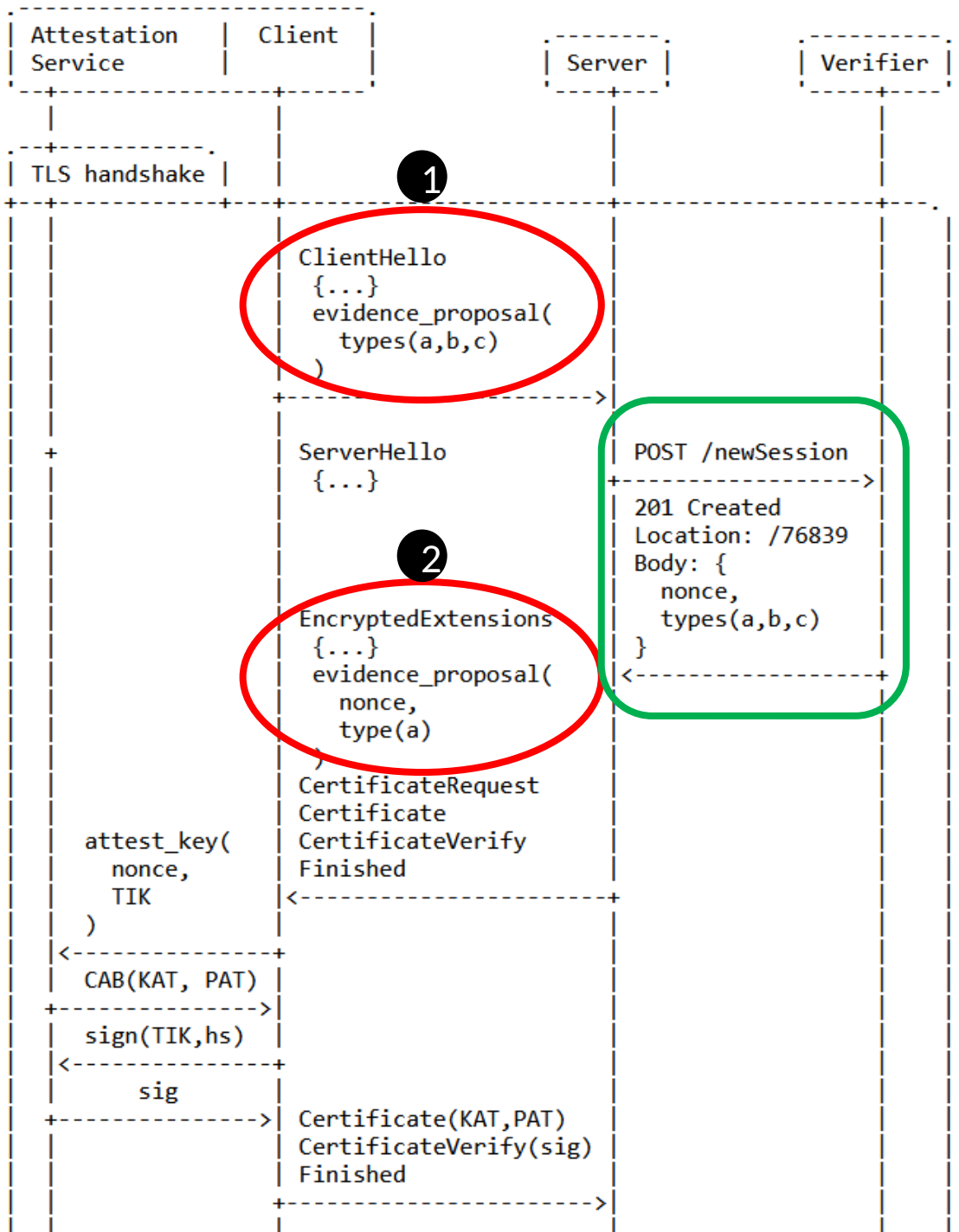
- Setup:
  - IoT device (TLS Client) is the attester
  - Onboarding server (TLS Server) is the relying party.

- Assume: Background Check Model (i.e. relying party conveys evidence from the attester to the verifier to obtain attestation results).

- TLS client indicates what formats of attestation technologies it supports. ❶

- TLS server selects what it wants to use (if anything). ❷

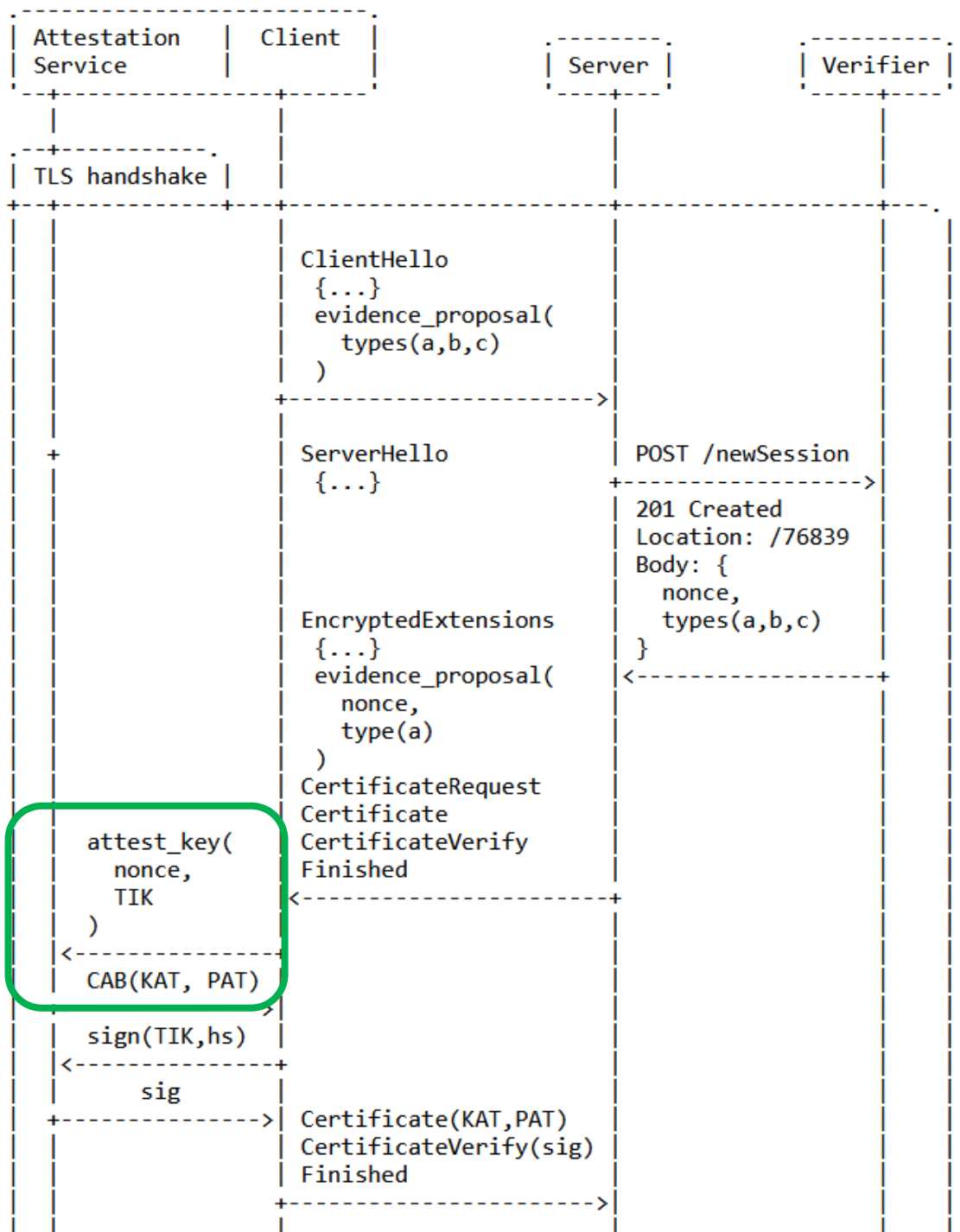
  It has to include a nonce (which it obtains from the verifier)

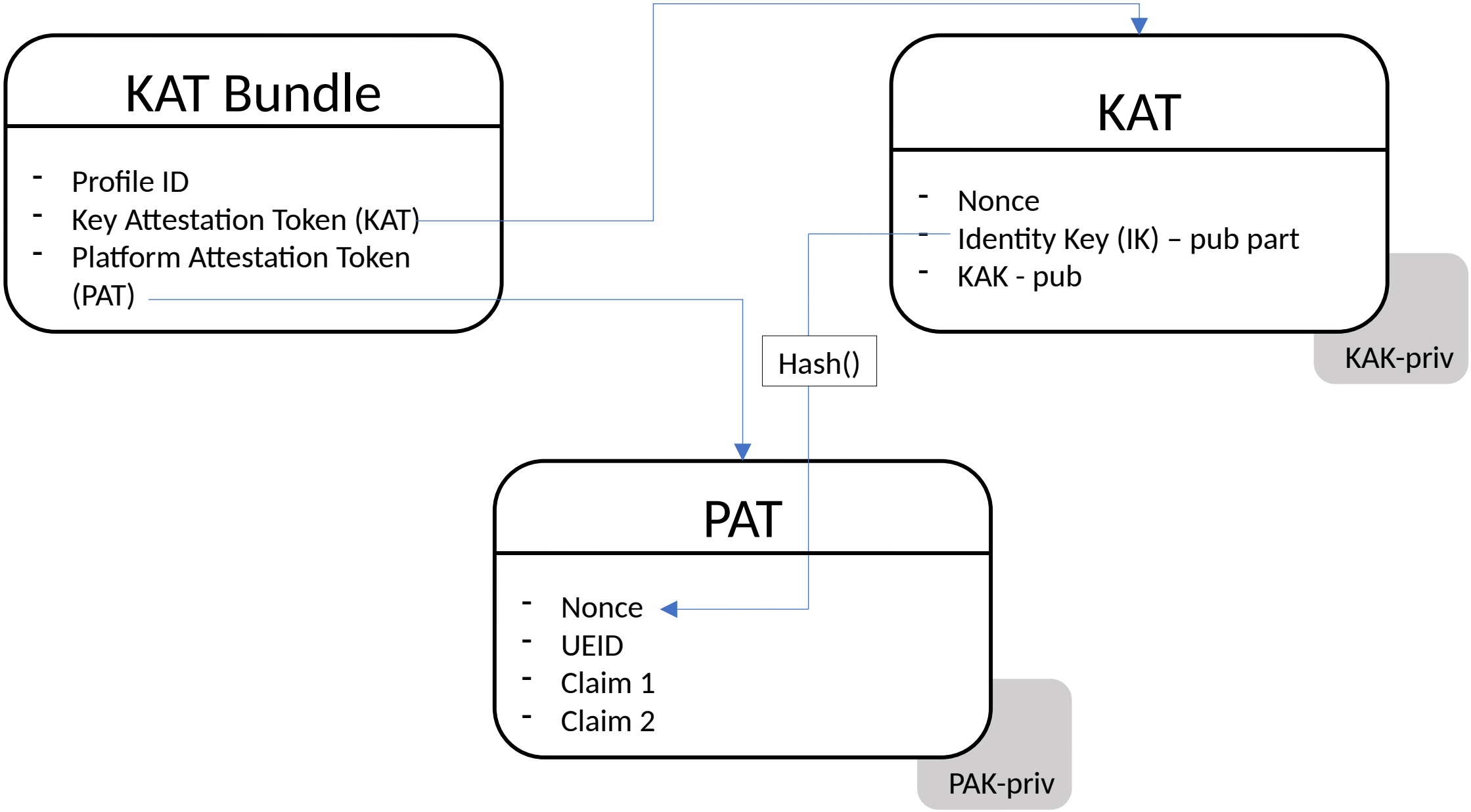


- TLS client creates Identity Key (IK) via the attestation service. Private key can not be exported.

- TLS client requests KAT Bundle with
  - Nonce, and
  - IK-pub

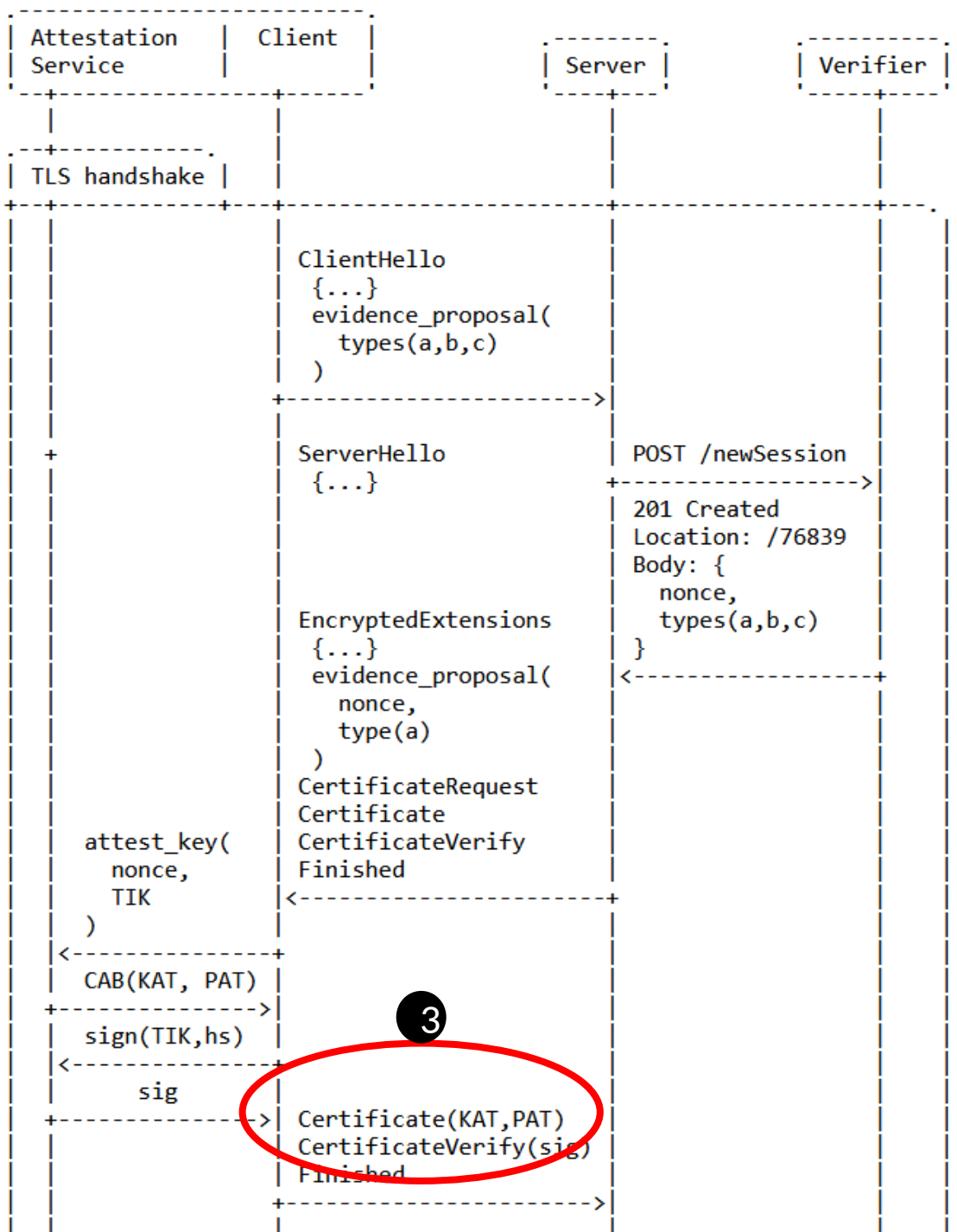
  as input.




KAT Bundle
- Profile ID
- Key Attestation Token (KAT)
- Platform Attestation Token (PAT)
KAT
- Nonce
- Identity Key (IK) – pub part
- KAK - pub
KAK-priv
Hash()
PAT
- Nonce
- UEID
- Claim 1
- Claim 2
PAK-priv

❸

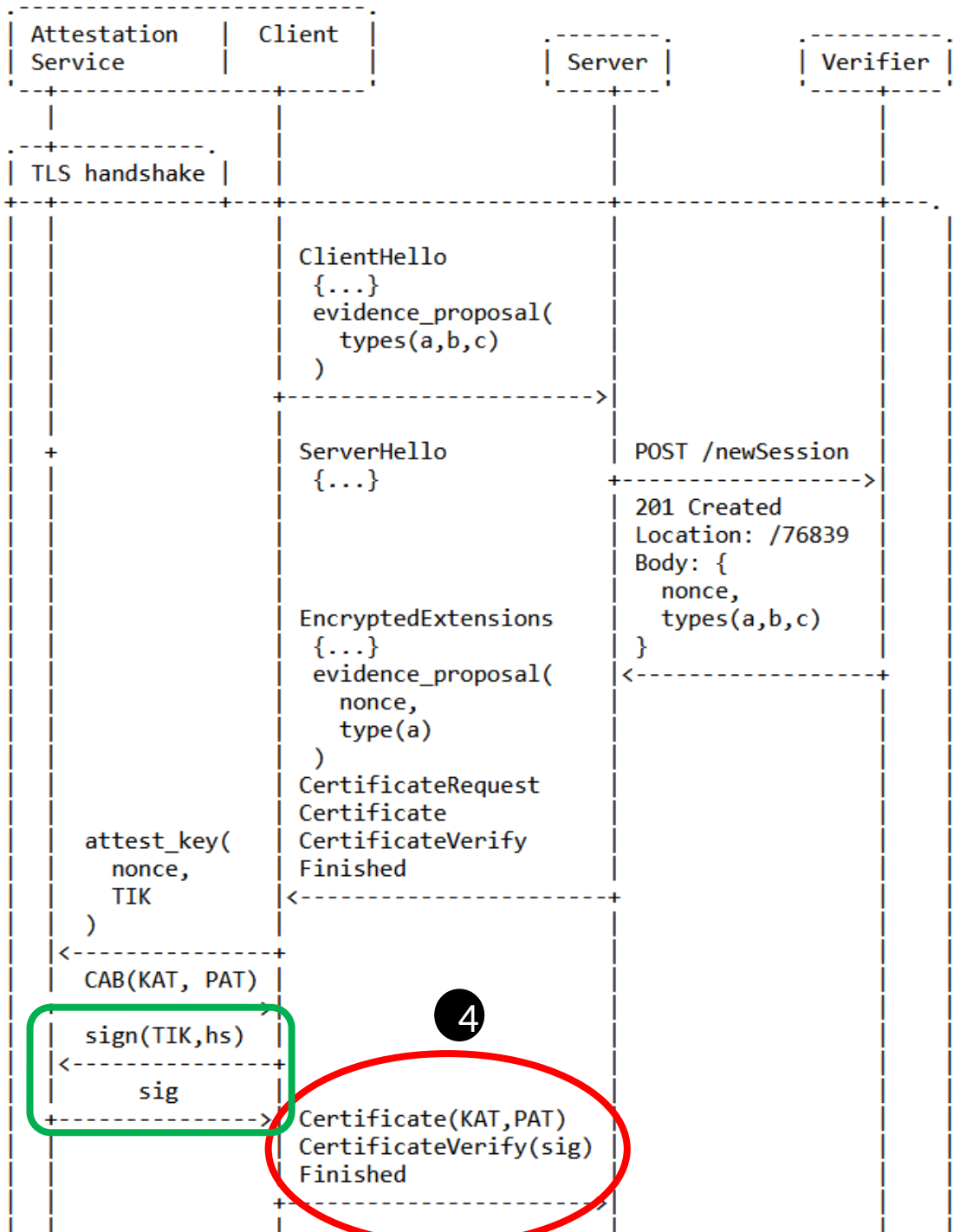
- TLS client conveys KAT Bundle in Certificate message to TLS server.



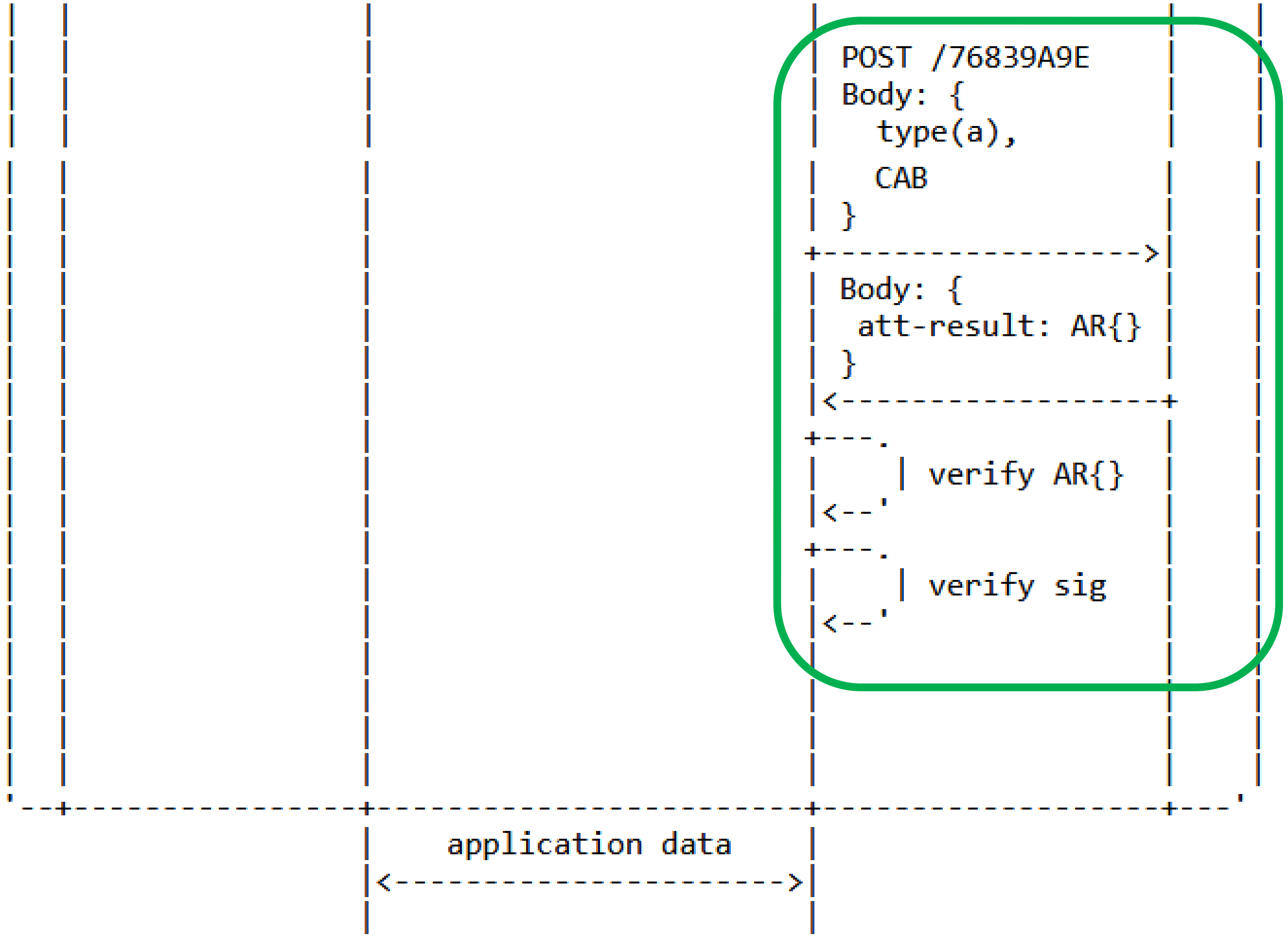
- TLS client uses IK priv to demonstrate possession of private key.

❹

- TLS client transmits CertificateVerify to server.



- TLS server passes the received evidence to the verifier.
- TLS server receives IK pub and attestation result from verifier.



```
 |  |            |                 |                  |  |
 |  |            |                 | POST /76839A9E   |  |
 |  |            |                 | Body: {          |  |
 |  |            |                 |   type(a),       |  |
 |  |            |                 |   CAB            |  |
 |  |            |                 | }                |  |
 |  |            |                 +----------------->|  |
 |  |            |                 | Body: {          |  |
 |  |            |                 |  att-result: AR{}|  |
 |  |            |                 | }                |  |
 |  |            |                 |<-----------------+  |
 |  |            |                 +---.              |  |
 |  |            |                 |   | verify AR{}  |  |
 |  |            |                 |<--'              |  |
 |  |            |                 +---.              |  |
 |  |            |                 |   | verify sig   |  |
 |  |            |                 |<--'              |  |
 |  |            |                 |                  |  |
 '--+------------+-----------------+------------------+--'
                 |  application data |
                 |<----------------->|
                 |                   |
```

Status

- Confidential computing use case also described in the draft (but not presented today).
  - TLS server is attested rather than the client.
- Prototyping effort ongoing and supported by CONFIDENTIAL COMPUTING CONSORTIUM
- Passport model not (yet) described in the draft.

More Info

- Drafts:
  - https://datatracker.ietf.org/doc/draft-fossati-tls-attestation/
  - https://datatracker.ietf.org/doc/draft-ftbs-rats-msg-wrap/
  - https://datatracker.ietf.org/doc/draft-bft-rats-kat/

- Prototyping code:
  - Veraison: https://github.com/veraison/services/tree/ietf-115-hackathon
  - Parsec: https://github.com/ionut-arm/parsec-se-driver/tree/attested-tls/
  - TLS extension: https://github.com/hannestschofenig/mbedtls/tree/tls-attestation