Intra-handshake.fail (CVE-2026-33697): High-severity CVE in Attested TLS

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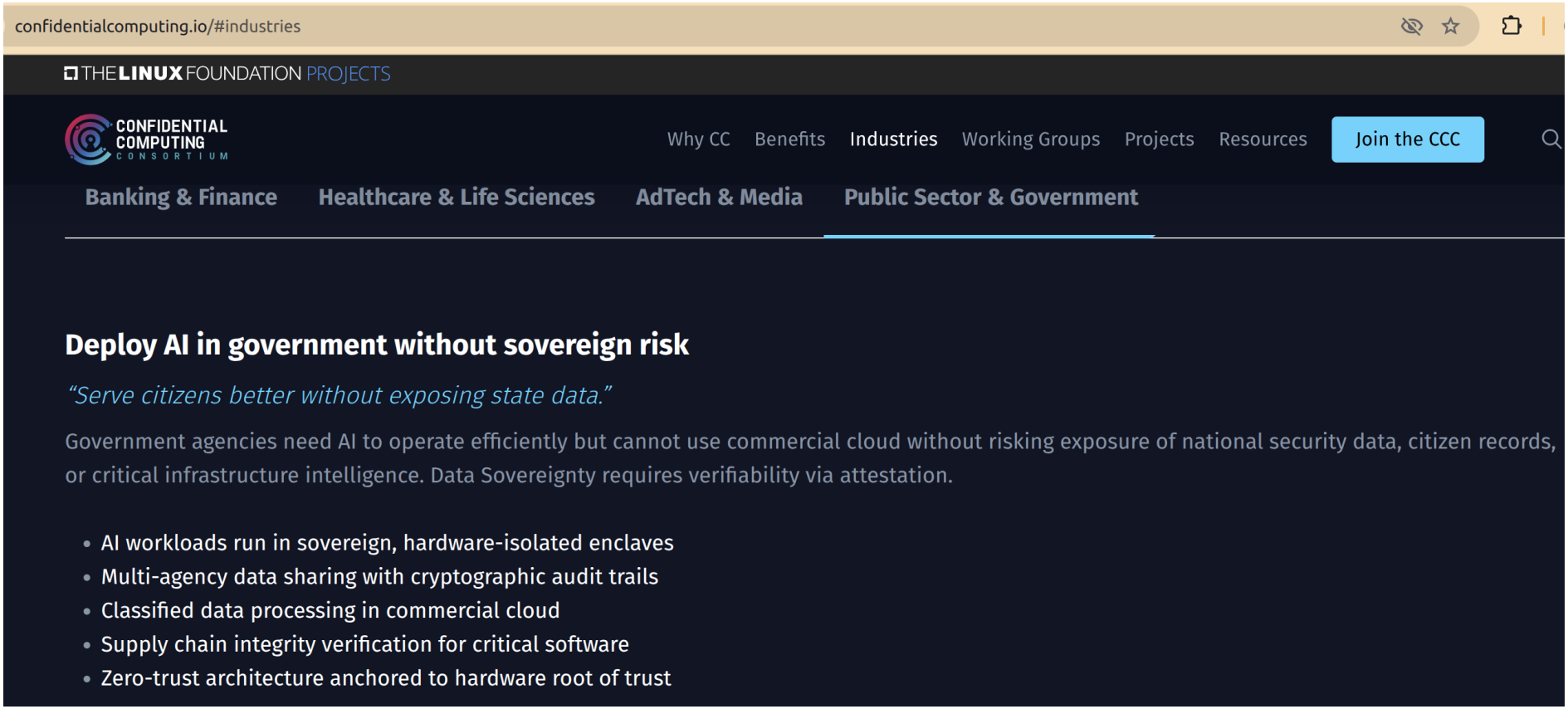
Use case: Trusted Research Environment (TRE) Scenario

Data source
(Verifying Relying Party)
(TLS Client)

Infrastructure provider
(Attester)
(TLS Server)

- Attestation: establish trustworthiness of endpoint

The Claim of Confidential Computing[1]



[1] `https://confidentialcomputing.io/#industries`

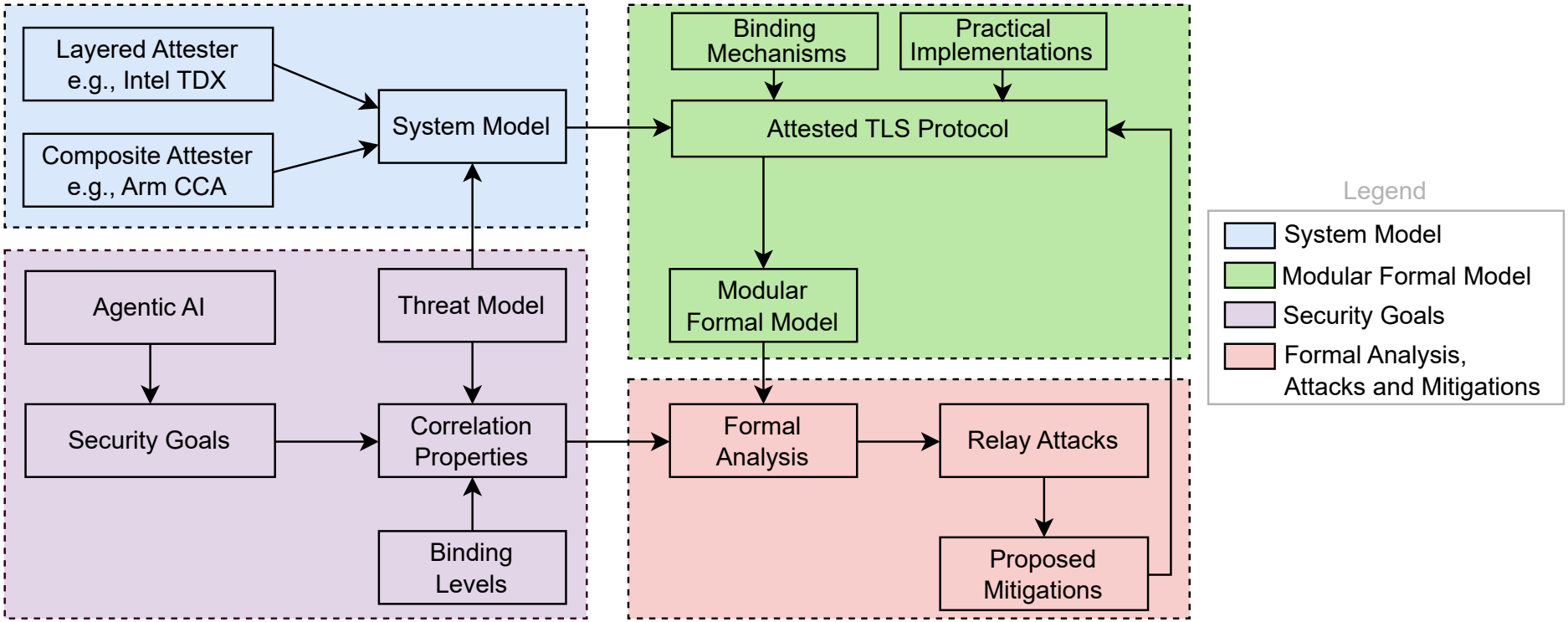
The Reality of Confidential Computing

- wiretap.fail: No CVE (Intel and AMD announcements)
- TEE.fail: No CVE
- TDXdown: CVSS **2.5** by Intel
- Staleus: CVE-2025-54509: CVSS **4.0**
- BreakFAST: CVE-2025-61972: CVSS **4.2** and CVE-2025-61971: CVSS **5.9**
- BadRAM: CVSS **5.3** by AMD
- Fabricked: CVE-2025-54510: CVSS **5.9**

We discovered CVE-2026-33697 of CVSS 7.5!

Approach

- TLS 1.3 as the transport protocol
- AI agents as motivational use case
- Formalization tool: ProVerif



Potential Binding Mechanisms (TLS Server as Attester)

S. No.	Binding material	Value of rdata field
1	Client's TLS nonce	nc
2	Client's attestation nonce	na
3	Early exporter	exp_0
4	Server's public key	pubEK
5	Client's attestation nonce and early exporter	na $\|$ exp_0
6	Client's attestation nonce and server's public key	na $\|$ pubEK
7	Nonce, server's public key, and early exporter	na $\|$ pubEK $\|$ exp_0

- Industry implementations: all are vulnerable
  - #1: Meta's AI
  - #6: Edgeless Systems Contrast, Cocos AI and CCC PoC[2]

[2] https://github.com/CCC-Attestation/attested-tls-poc

Binding Levels

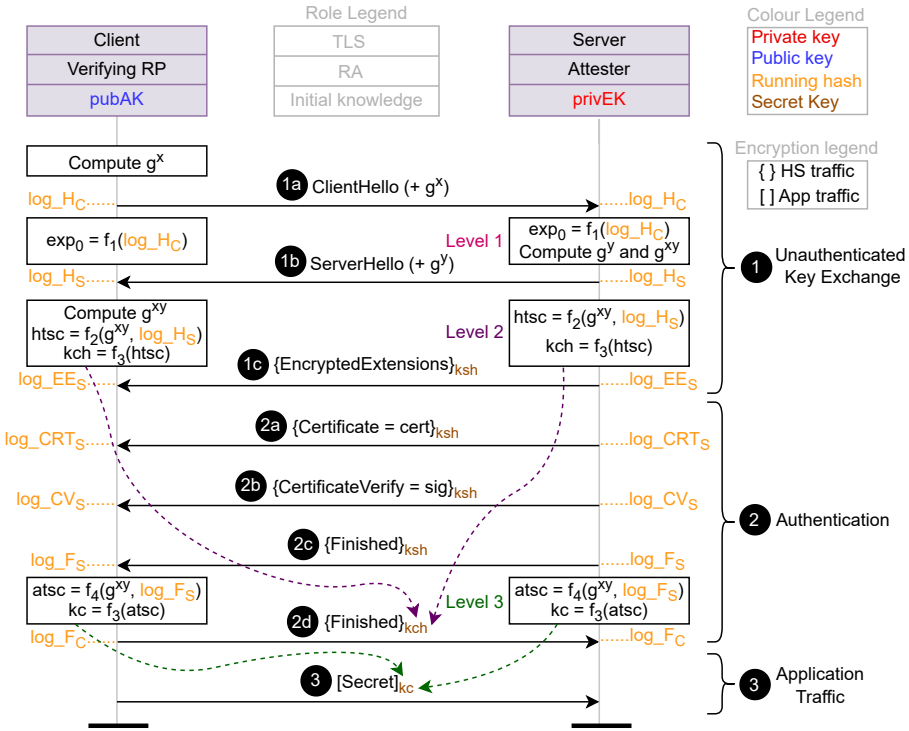
$$\forall\ ev, x, y.\ action(ClientX(ev, x)) \wedge action(ServerX(ev, y)) \rightarrow x = y \tag{1}$$

Level	Secret	Handshake state
1	DH shared secret (g^{xy})	g^x from ClientHello and g^y from Server
2	Client's handshake traffic key (*htsc*)	complete ClientHello and ServerHello
3	Client's application traffic key (*atsc*)	ClientHello up to ServerFinished

$$G_3 \Rightarrow G_2 \Rightarrow G_1 \tag{2}$$

Binding to Client Handshake Traffic Secret is Not Sufficient

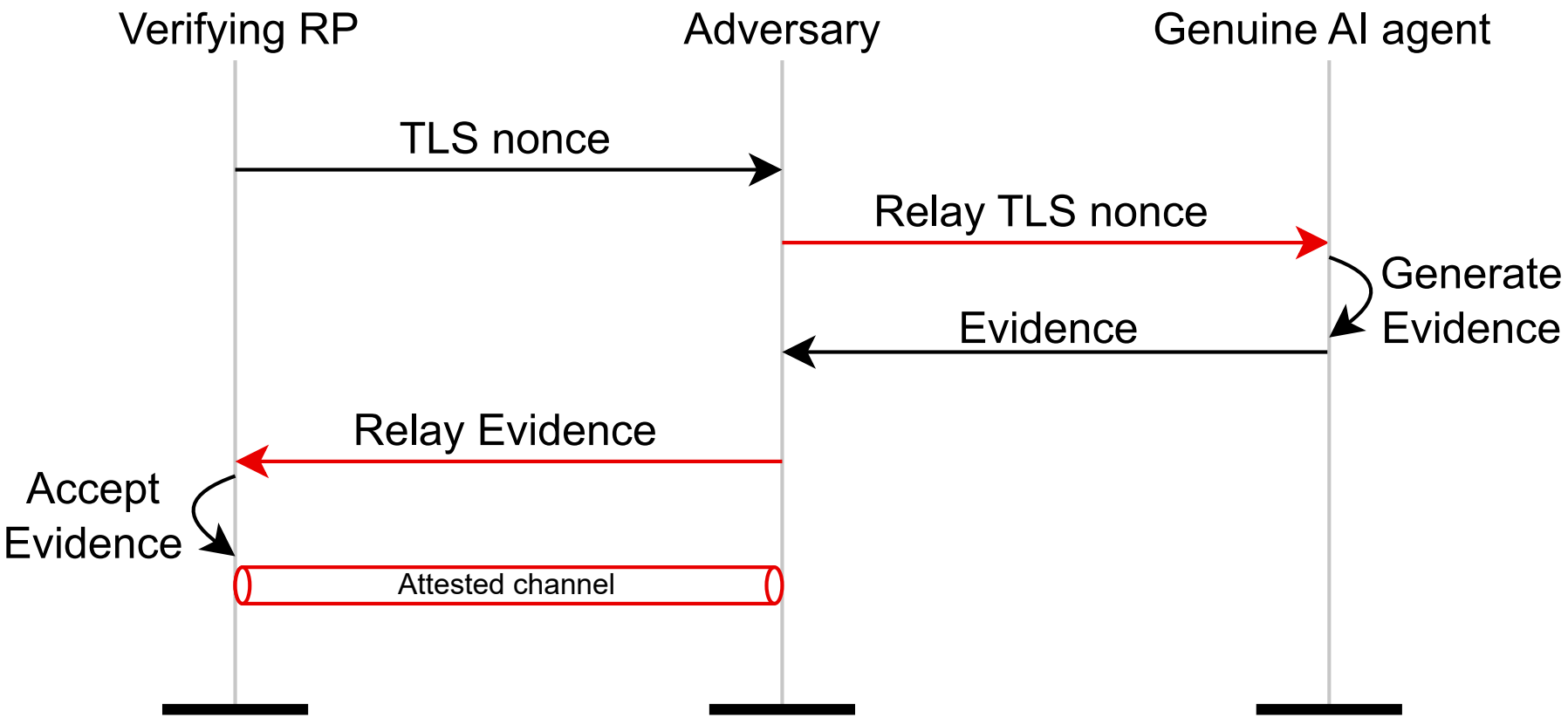
Devil is in the Details!



- `htsc`: used for encryption of clientFinished message (2d).
  - Irrelevant for security goals
  - Server not yet authenticated at this point
- `atsc`: used for encryption of application data (client's secret, e.g., decryption key)
  - Relevant for security goals

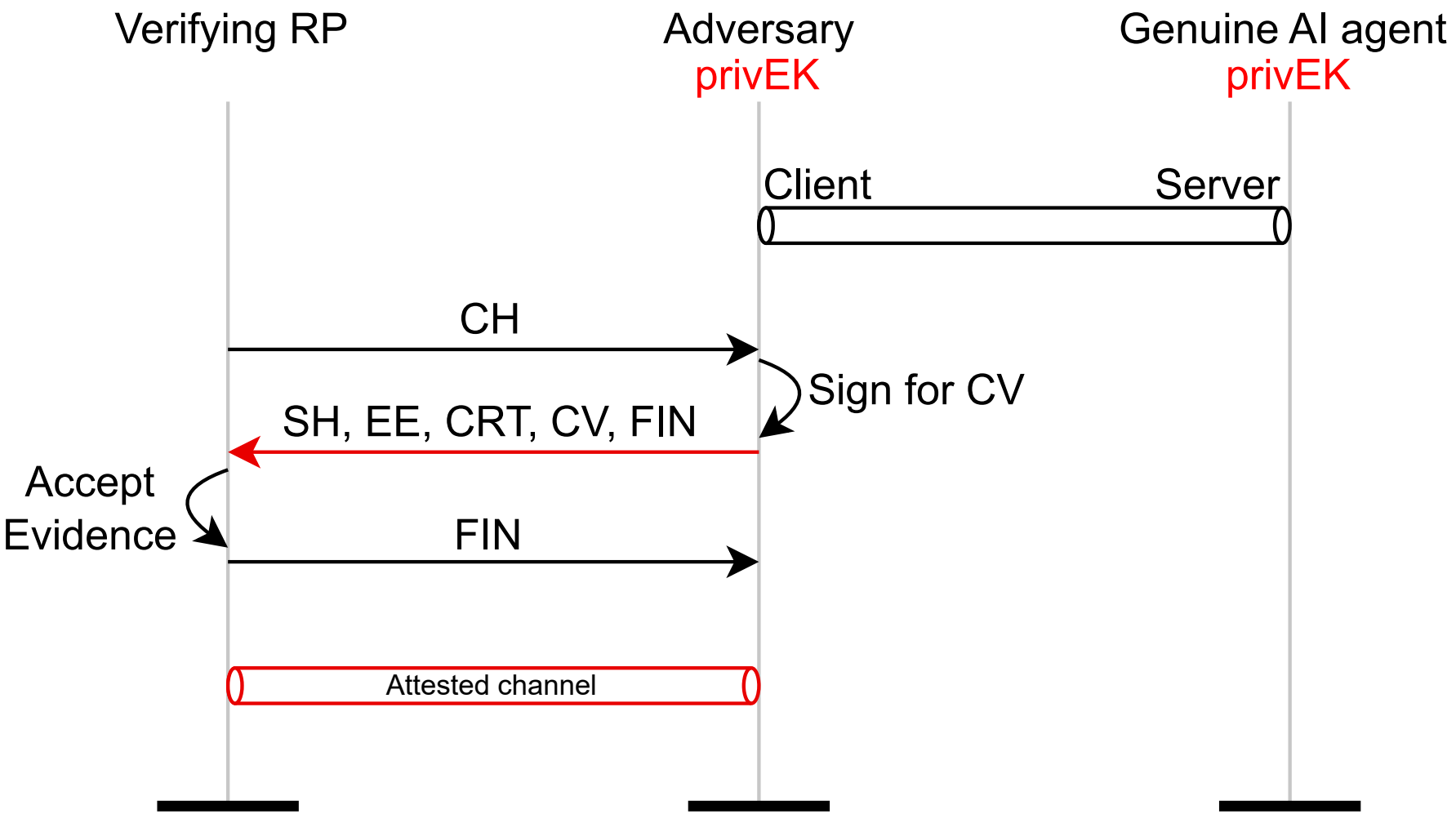
Relay Attack 1 (Abstracted): Mechanism # 1 (nc)

- Adversary can relay nonce to a genuine Attester



Relay Attack 2 (Abstracted): Mechanism # 4 (pubEK)

- No protection if privEK is accessible to some entity other than an AI agent (e.g., provisioning at runtime) or leaked via vulnerability in code
- Adversary gets signed Evidence from genuine AI agent



High-severity CVE Published

CWE 2 Total

Learn more

- CWE-322: CWE-322: Key Exchange without Entity Authentication
- CWE-346: CWE-346: Origin Validation Error

CVSS 1 Total

Learn more

Score	Severity	Version	Vector String
7.5	HIGH	3.1	CVSS:3.1/AV:L/AC:H/PR:L/UI:N/S:C/C:H/I:H/A:N

- Drafts vulnerable to CVE-2026-33697
  - draft-fossati-tls-attestation[3]
  - draft-fossati-seat-early-attestation[4]
  - draft-ritz-seat-facts[5]

[3] https://datatracker.ietf.org/doc/draft-fossati-tls-attestation/

[4] https://datatracker.ietf.org/doc/draft-fossati-seat-early-attestation/

[5] https://datatracker.ietf.org/doc/draft-ritz-seat-facts/

Core Problem

Binding Evidence to
unauthenticated peer (Server)

Summary of Security Analysis So Far

- Pre-handshake attestation: replay and diversion attacks
- Intra-handshake attestation: diversion and relay attacks
  - draft-fossati-tls-attestation[6]
  - draft-fossati-seat-early-attestation[7]
  - draft-ritz-seat-facts[8]
- Post-handshake attestation
  - draft-fossati-seat-expat[9]

- Intra-handshake attestation can achieve at most level 2 binding

- Unless one re-establishes connection each time attestation is required, post-handshake attestation is required, and hence, intra-handshake only adds unnecessary complexity.
- Several other CVEs under responsible disclosure

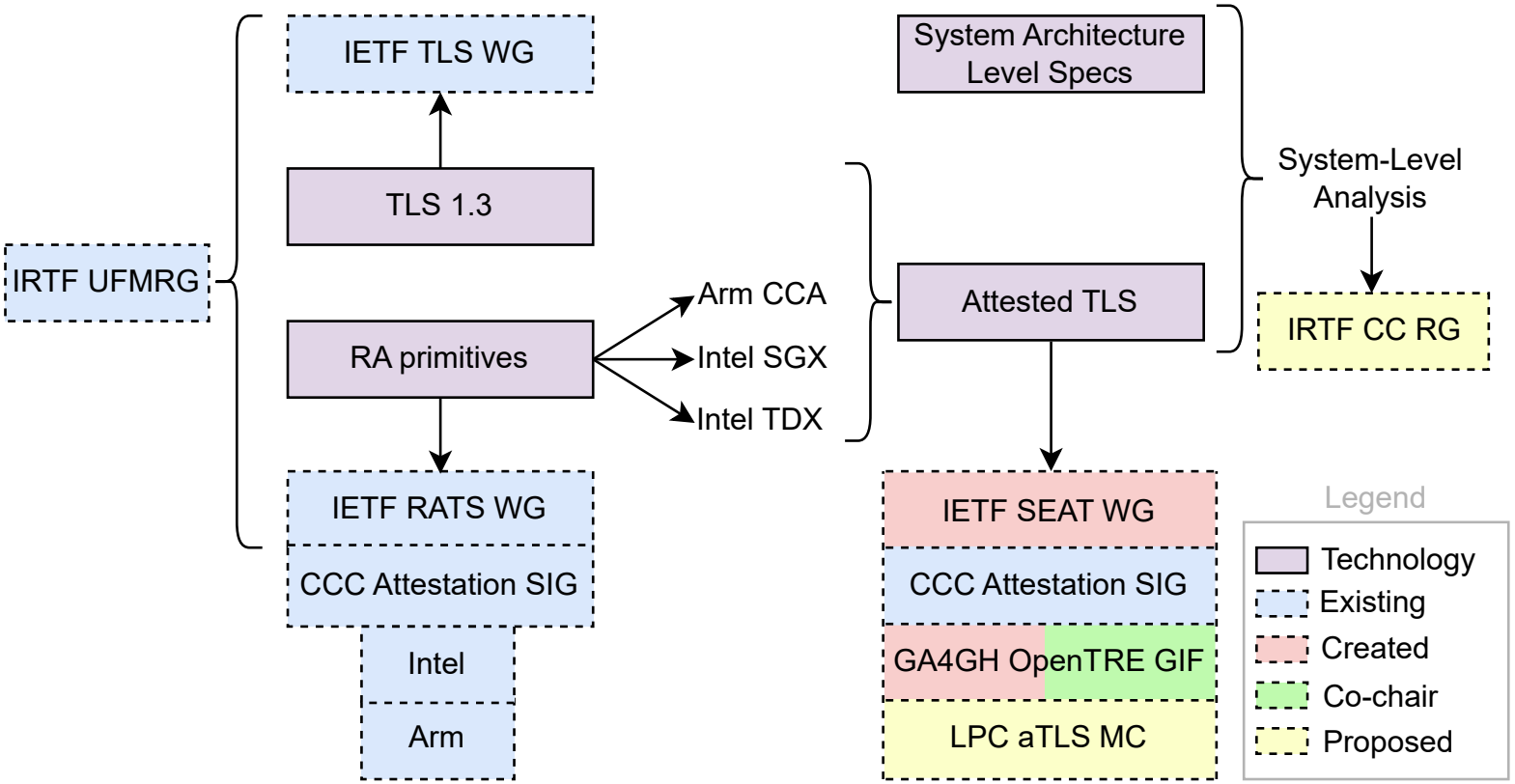
[6] https://datatracker.ietf.org/doc/draft-fossati-tls-attestation/

[7] https://datatracker.ietf.org/doc/draft-fossati-seat-early-attestation/

[8] https://datatracker.ietf.org/doc/draft-ritz-seat-facts/

[9] https://datatracker.ietf.org/doc/draft-fossati-seat-expat/

Big Picture and Next Steps



- IETF: Internet Engineering Task Force
- IRTF: Internet Research Task Force
- CCC: Confidential Computing Consortium
- GA4GH: Global Alliance for Genomics and Health
- RATS: Remote ATtestation ProcedureS
- TLS: Transport Layer Security
- SEAT: Secure Evidence and Attestation Transport

- UFMRG: Usable Formal Methods Research Group
- CC: Confidential Computing
- WG: Working Group
- RG: Research Group
- aTLS: Attested TLS
- SIG: Special Interest Group
- OpenTRE: Trusted Research Environment Open Suite

Links to Resources

- Paper
  - https://www.researchgate.net/publication/408219182_Intra-handshakefail_CVE-2026-33697_High-severity_CVE_in_Attested_TLS
- ProVerif artifacts
  - https://www.github.com/muhammad-usama-sardar/intra-handshake.fail

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