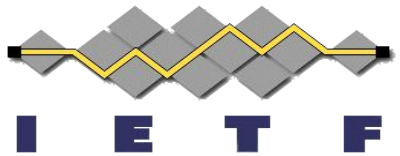
New Cryptography at the IETF



SAAG

IETF 118, Prague

November 9th, 2023

Goal

Cryptography is a *tool* and often times only part of a solution

Examples:

- Public key encryption in TLS ECH, MLS, and OHTTP
- PAKE in WhatsApp end-to-end encrypted backups
- Privacy Pass in Apple's Private Access Tokens
- Signatures with selective disclosure in Verifiable Credentials

Briefly survey high-level features and usage considerations for some new cryptography and security specifications

Tool: Public Key Encryption

Purpose: encrypt application data under a public key

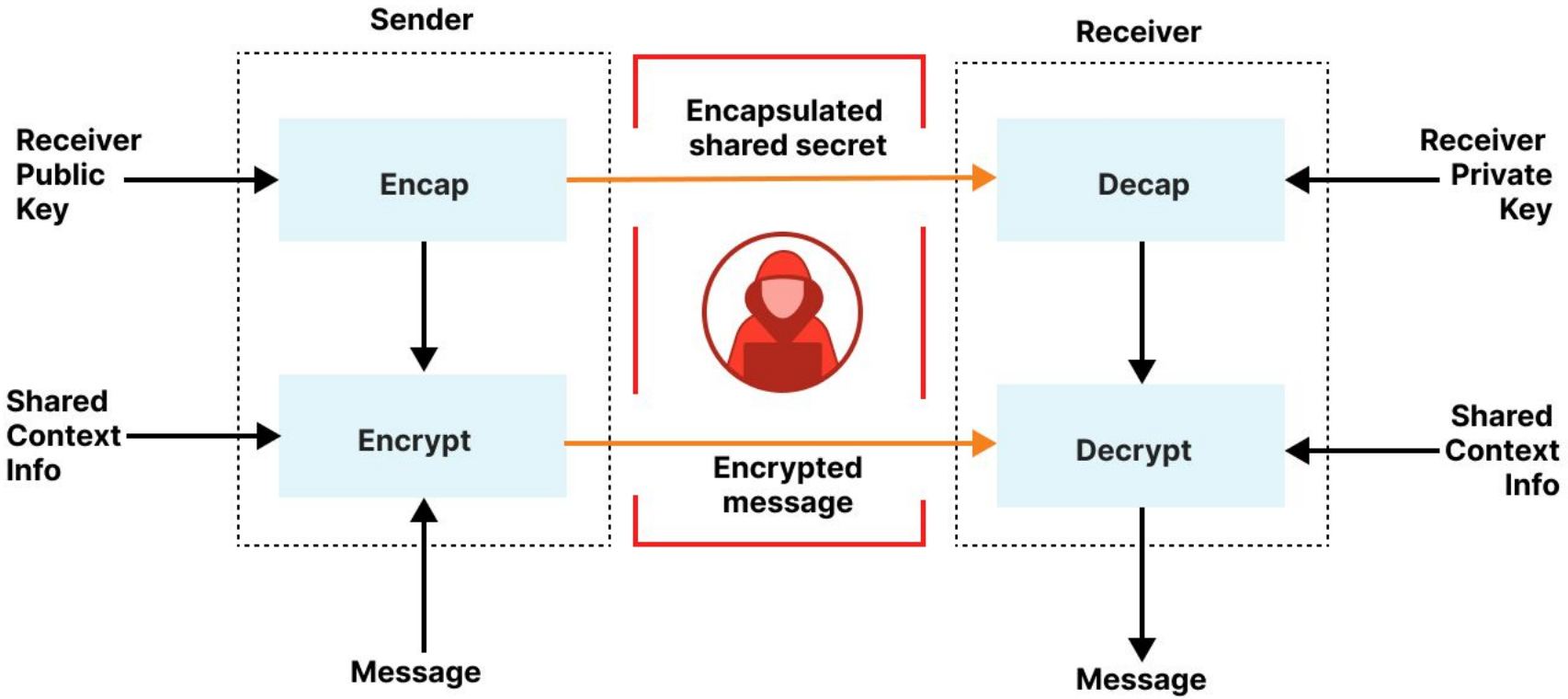


Image: blog.cloudflare.com

Tool: Public Key Encryption

Examples: TLS ECH, MLS, OHTTP / ODoH, DAP

Considerations:

- How to authenticate the public key?
- How to distribute the public key?

Reference: RFC 9180 (CFRG)

Protocol: PAKE

Purpose: establish a shared secret authenticated by a password

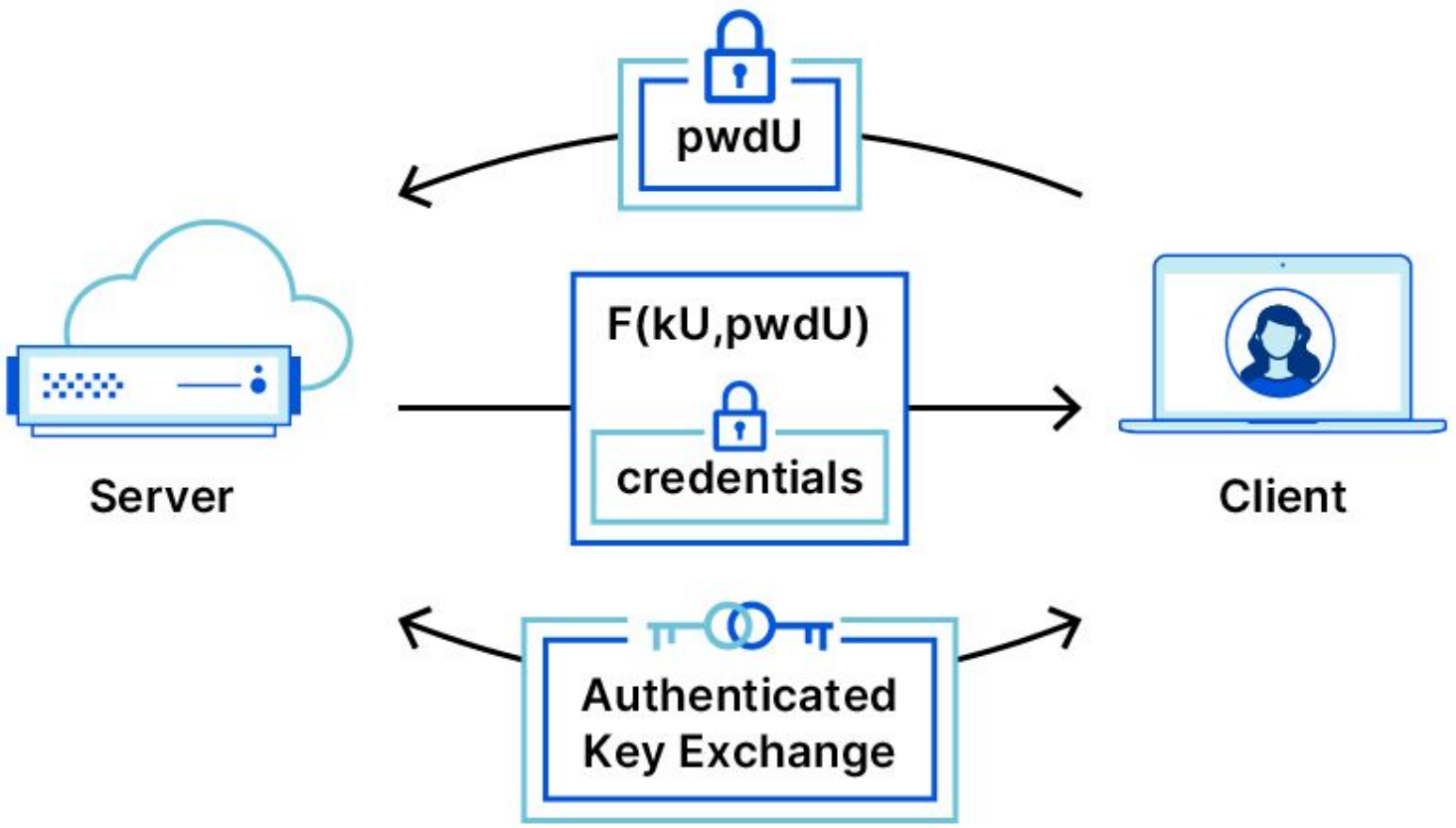


Image: blog.cloudflare.com

Protocol: PAKE

Examples: Device pairing (Thread / Matter), end-to-end encrypted backup (WhatsApp), secure channel establishment

Considerations:

- Would public key authentication be better?
- Do both parties need the password (for policy enforcement)?
- Is the attacker able to brute force “login” attempts?

References: draft-irtf-cfrg-opaque, draft-irtf-cfrg-cpace (CFRG)

Protocol: Private Aggregation

Purpose: privately compute aggregate functions without learning individual aggregate inputs

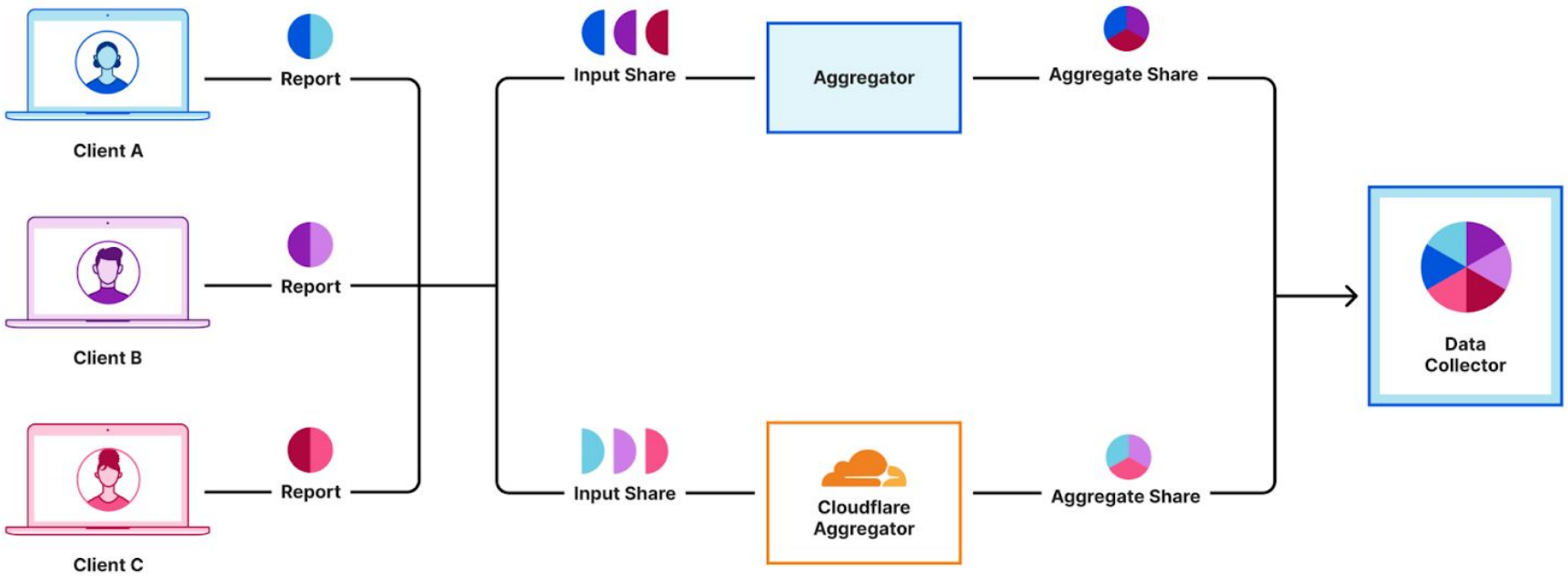


Image: blog.cloudflare.com

Protocol: Private Aggregation

Examples: Private aggregation (DiviiUp), Exposure Notification Private Analytics (Apple / Google)

Considerations:

How are non-collusion requirements guaranteed?

How does the aggregate function fit into the privacy threat model?

How are aggregation parameters configured and distributed?

References: draft-ietf-ppm-dap (PPM)

Protocol: Private Authorization

Purpose: authorize clients without revealing unique client information

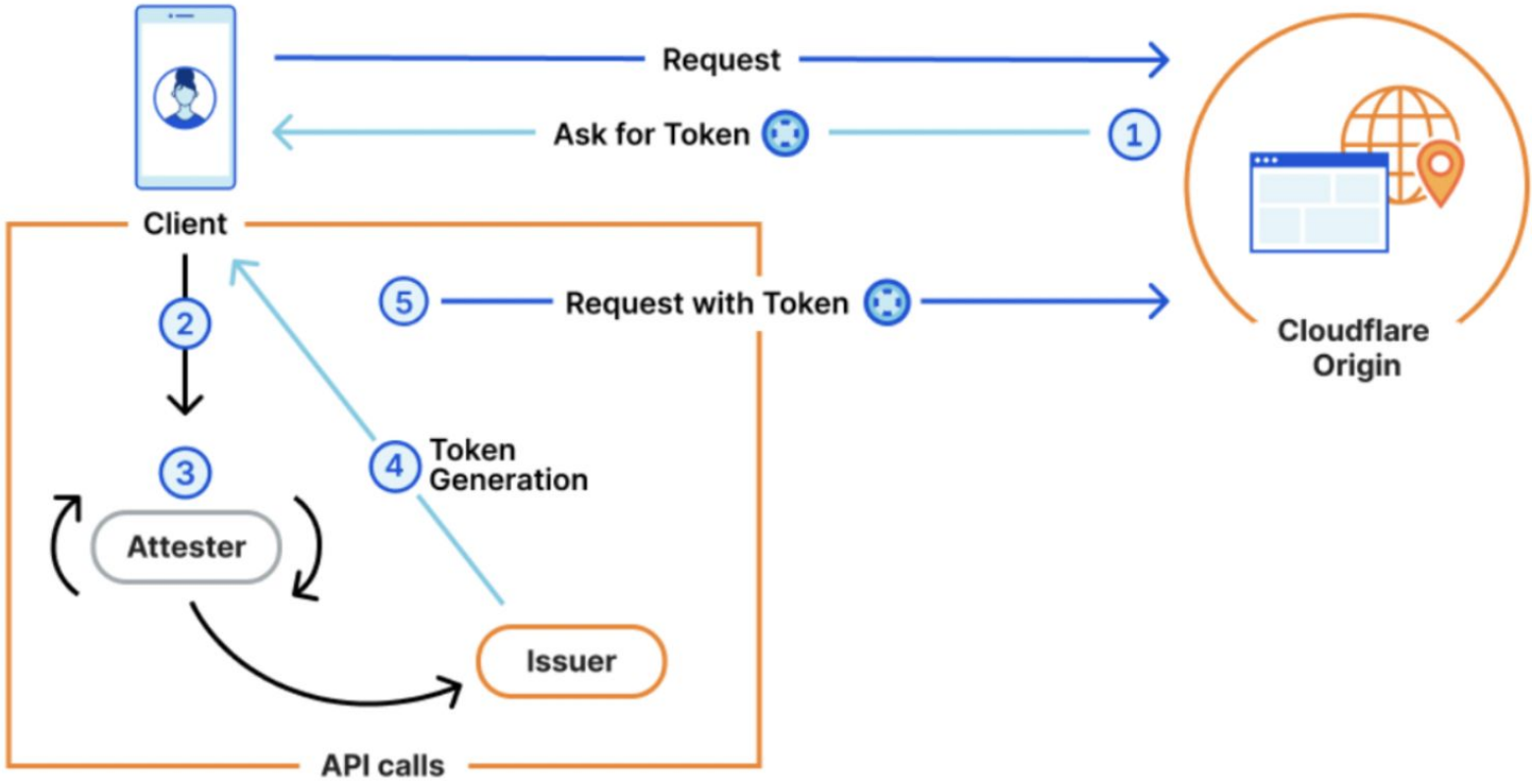


Image: blog.cloudflare.com

Protocol: Private Authorization

Examples: CAPTCHA solution signal (Cloudflare Privacy Pass), Private Access Tokens (Apple), Sybil attack prevention (Distributed Aggregation Protocol)

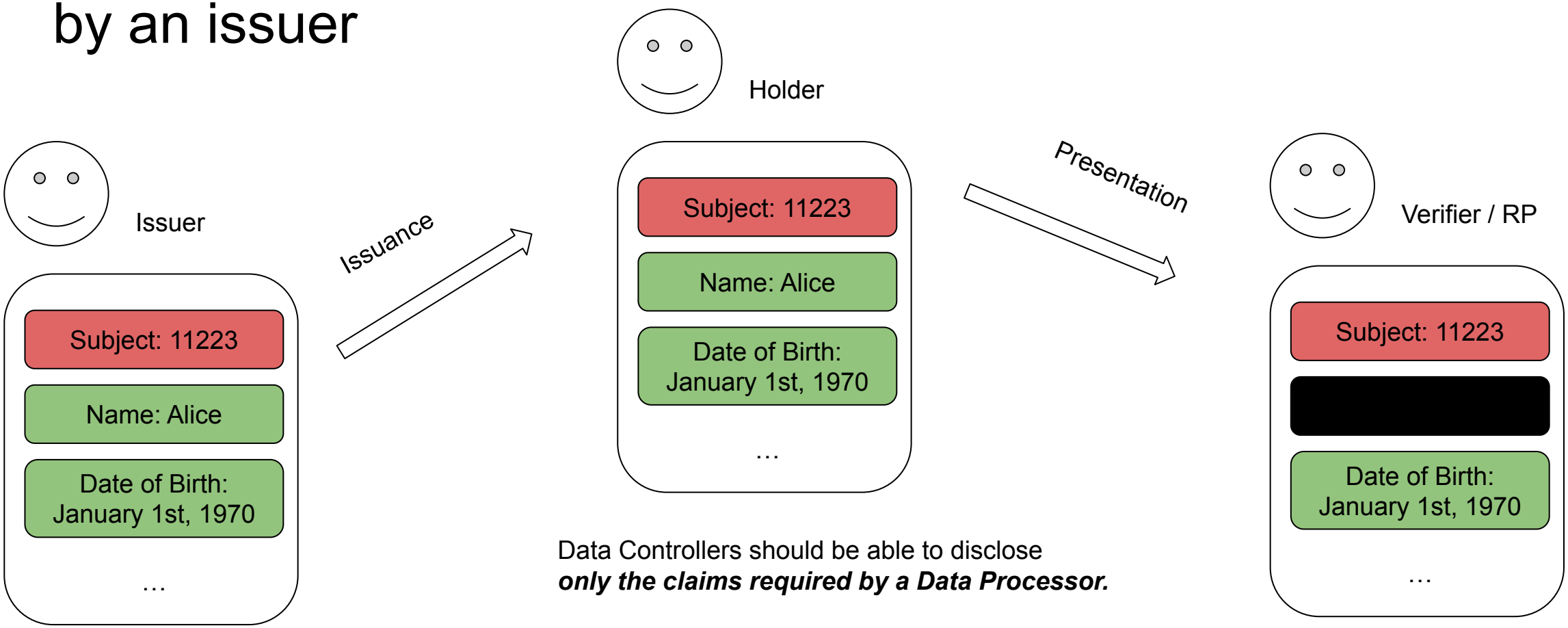
Considerations:

- What signal is the client providing when authorizing?
- Are replay and token hoarding attacks a concern?

References: draft-ietf-privacypass-architecture

Protocol: Selective Disclosure

Purpose: selectively disclose a subset of attributes authorized by an issuer



Data Controllers should be able to disclose
only the claims required by a Data Processor.

Protocol: Selective Disclosure

Examples:
- Digital Driver's License
- Proof of Vaccinations
- Redacted Trade / Supply Chain Documents

References:

- draft-ietf-oauth-selective-disclosure-jwt
- vc-jose-cose (W3C)
- imda.gov.sg/.../international-trade-and-logistics/tradetrust
- ISO mDoc

Takeaway

Cryptography is a *tool*, and tools can be harmful

Anti-patterns:

1. “How can I implement and deploy the cryptography I found in this new paper?”

→ Focus on problems, not solutions

2. “We can just plug in <X> and it should be fine”

→ Demand formal security analysis when using these tools

3. “If we modify things like <X> then tool <Y> will work for us”

→ Collaborate with people working on standards!