The Sigsum transparency system

2026-04-24

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Slides: `https://git.glasklar.is/nisse/chains-2026`

Digital signatures everywhere

We can imagine supply-chain tooling enforcing:

- Signed source releases.
- Signed binaries and updates.
- Signed repro build claims.
- Signed attestations?

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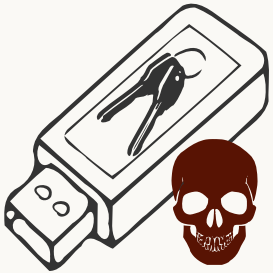
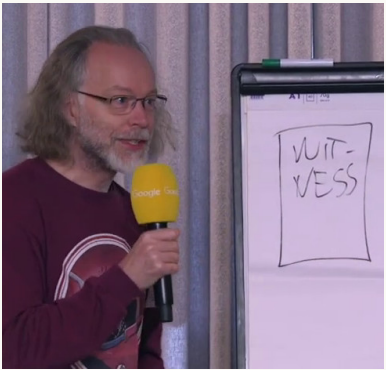


Would you know if a signing key is compromised?

Outline



Transparency logs and Sigsum

What's a transparency log?

- Append-only log.
- Merkle tree inside.

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Transparency logs and Sigsum

What's a transparency log?

- Append-only log.
- Merkle tree inside.

What's Sigsum?

- Minimalistic transparency log.
- A FOSS project started ca 2020.
- Distributed (but not decentralized).
- Stable specs, pretty good tools.
  `https://www.sigsum.org/docs`

Matthew Paul Argall CC-BY
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Motivation: Rogue software update

Setting:

- Automatic software updates, properly signed.
- Attacker gains control of signing key.
- Attacker delivers rogue updates to targeted users.

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Why transparency?

- Prevent? ❌
- Detect? ✅
- Recover? ⚠️

Threat model

The attacker owns:

- Release signing key.
- Distribution infrastructure.
- Sigsum log server.
- Some cosigning witnesses.

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Aim: Detect attacks, deter attackers.

THE SIGSUM SYSTEM

Sigsum

- Log entries are signed checksums.

Sigsum

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A log entry

Checksum	What?	32
Pubkey hash	By whome?	32
Signature	Binding	64
		bytes

Sigsum

- Log entries are signed checksums.
- Designed for public usage.
- Building block for transparency.

A log entry

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Pubkey hash	By whome?	32
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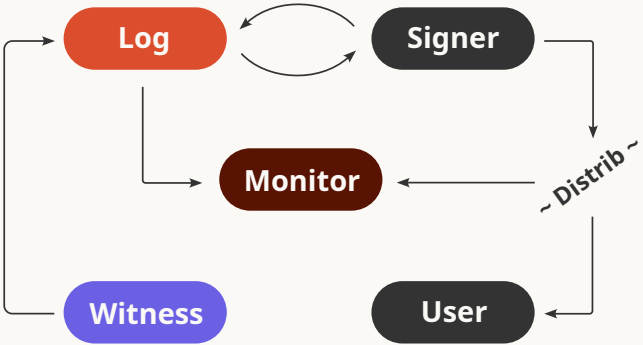
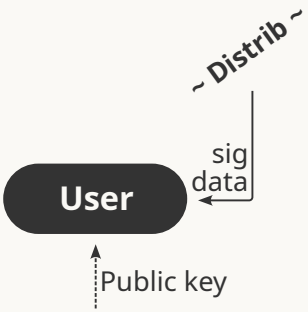
System overview

The entities in the Sigsum system:

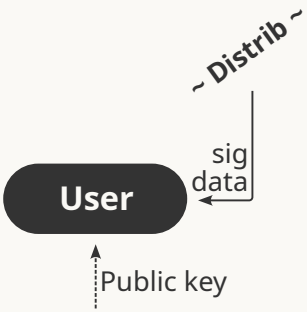


User perspective



Without Sigsum

User perspective



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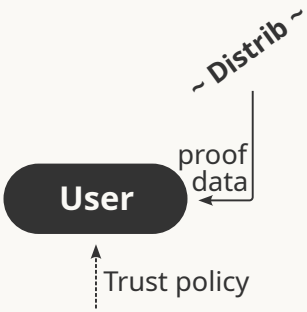
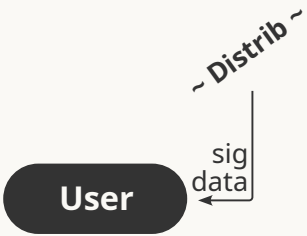
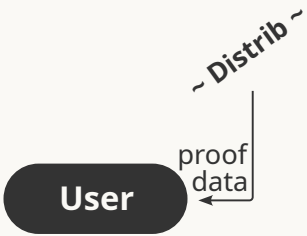


With Sigsum

User perspective



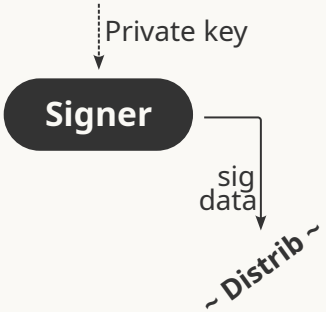
Without Sigsum



With Sigsum

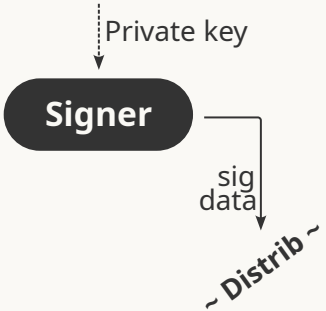
Offline verification.

Signer perspective

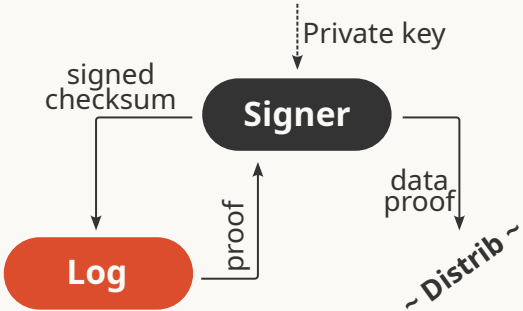


Without Sigsum

Signer perspective

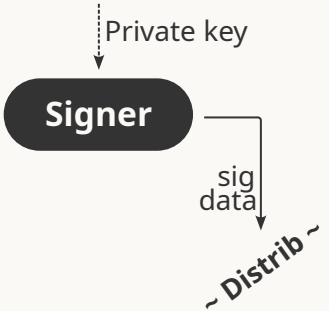


Without Sigsum



With Sigsum

Signer perspective



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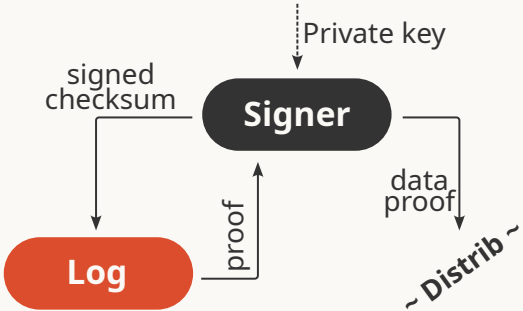

With Sigsum

Depends on the log being available at signing time.

Monitor perspective

:(

Without Sigsum

Monitor perspective

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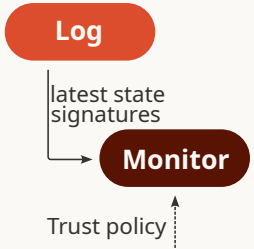

Without Sigsum

With Sigsum

Monitor perspective

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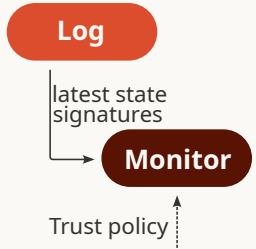

Without Sigsum

With Sigsum

All user-accepted signatures can be discovered.

Monitor perspective

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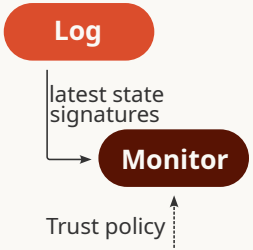

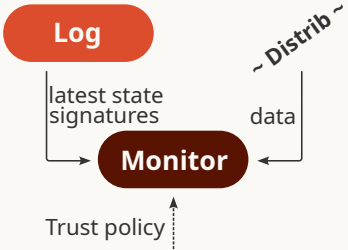

Without Sigsum | **With Sigsum** | **Also with Sigsum**

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Split view?

- Critical that monitor and user see the **same** log.
- What if the log looks different depending on who's asking?

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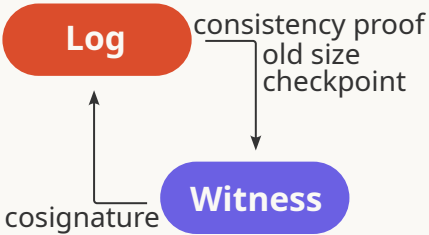
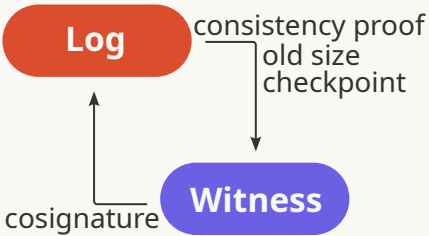
Don't want a single point of trust.

Enter witnesses



- Witness: “All older entries still there.”

Enter witnesses



- Witness: "All older entries still there."
- Witness cosignatures are included in proofs.
- Require cosignatures from m of n witnesses.
- User and monitor agree on trusted witnesses.

Witnesses are light

- Witnesses care about consistency, not contents.
- Modest storage, processing and bandwidth.
- Configuration via `https://witness-network.org/`

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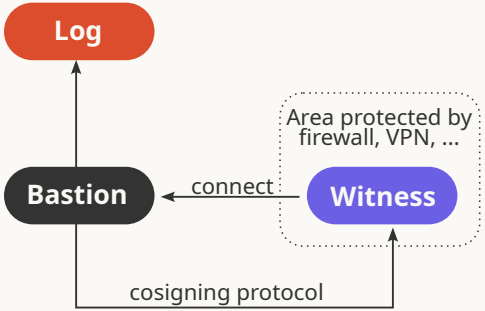

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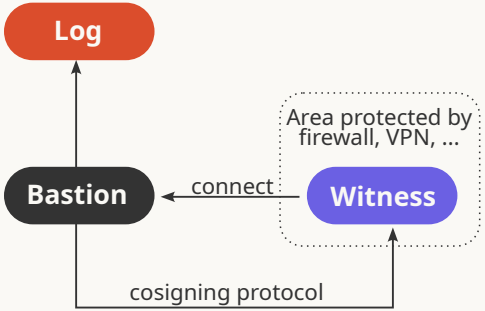

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- Configuration via `https://witness-network.org/`
- Does not need any publicly known IP address.

Does need secure and reliable operation.

Trust policy

The sigsum-generic-2025-1 policy:

```
log 0ec7e16843119b120377...1f25 https://seasalp.glasklar.is
log f00c159663d09bbda613...8314 https://ginkgo.tlog.mullvad.net

witness glasklar   b2106db9065ec97f25e0...8536
witness mullvad    15d6d0141543247b74ba...61ad
witness tillitis   076be8c9ee7ea60916f0...770c

group quorum-rule 2 glasklar mullvad tillitis
quorum quorum-rule
```

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quorum quorum-rule
```

Wanted: Additional independent witness operators.

CASE STUDY

Case study: Reproducible builds in System Transparency

Question: What software is running on that server?
Prototype: `https://git.glasklar.is/nisse/st-complete-poc`

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System transparency combines:

- Transparency logging.
- Reproducible builds.
- Remote attestation.

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System transparency combines:

- Transparency logging.
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Aim: Detect if server's supply-chain is compromised.

Remote attestation TL;DR

Components:

- Firmware (UEFI/BIOS/coreboot/...).
- Trusted Platform Module (TPM).
- Client/Server protocol.

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```
PCR#4=43929c6dacb28003d46aa24d45cf73c7d4000a33fc08903bb4cf26602dc85a9d
```

Now what?

A repro build claim

```
$ GET https://tee.sigsum.org/~nisse/pcr/43/43...9d

claim-type=st-poc-pcr-claim-v0
pcr-index=4
pcr-sha256=43929c6dacb28003d46a...5a9d
commit=c07bcf80bde72d6627007ae9f934b6a77c2b8073

version=2
log=4e89cc51651f0d95f3c6...bb4d
leaf=ddce2439d2b04384adc5...13ea 3b22691a57d125d67126...770d

size=4371
root_hash=e8cb842eebcd5c671838...3e42
...
```

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A Sigsum logged claim that the PCR#4 is valid and reproducible from source.

Monitoring

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- Use checksum to retrieve corresponding claim from archive.

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- Build the bootloader image.
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- Raise an alarm if any of these steps fail.

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Sigsum does not prevent false claims, but enables detection.

SUMMARY

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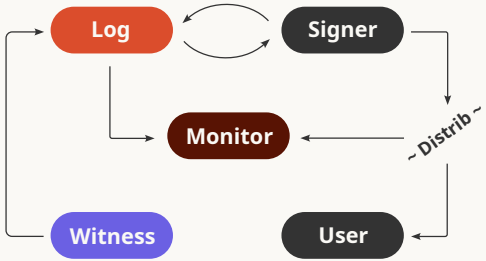

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- Signatures have meaning to applications.
- Trusted when cosigned by witnesses.

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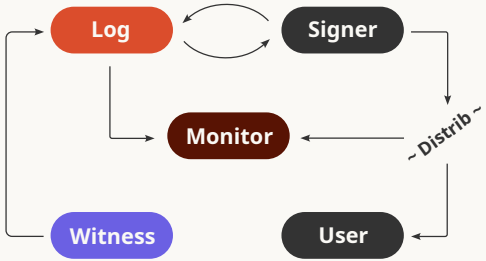

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Concretely:

- Submit and collect proof when signing.
- Bring your own distribution.
- Offline verification.
- Monitor logs, for keys of interest.

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Do you want to be a witness operator?