Chair of Distributed Systems & Operating Systems
Department of Computer Science // TUM School of Computation, Information and Technology
Technical University of Munich

Kernel Functions of a Trusted NIC Architecture

Guided Research

Robert Schambach

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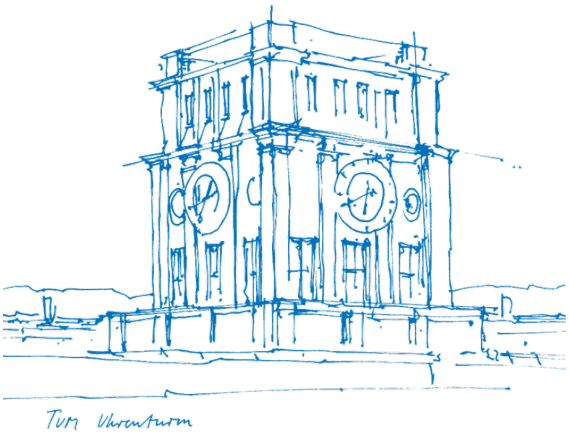
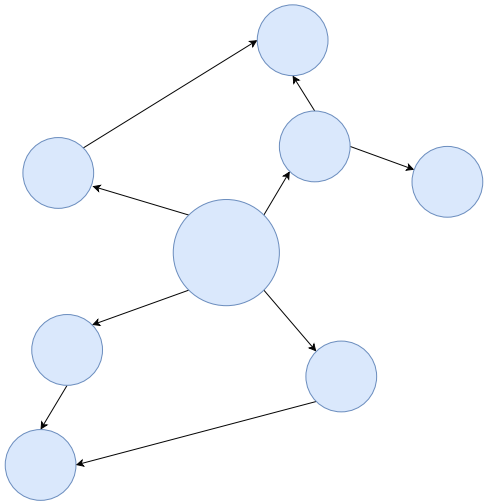
June 5th, 2023



Problem Statement



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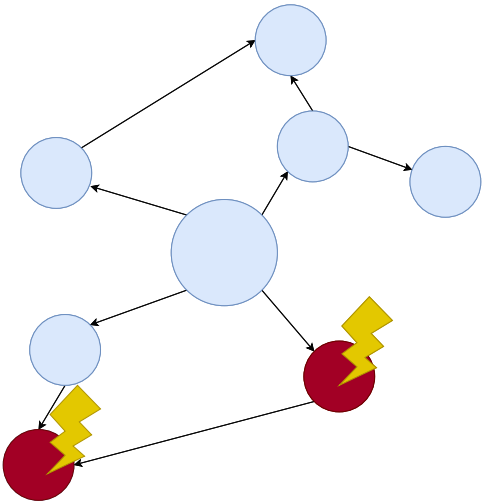

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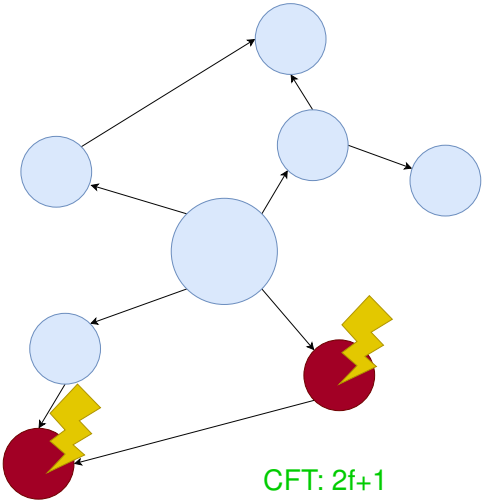

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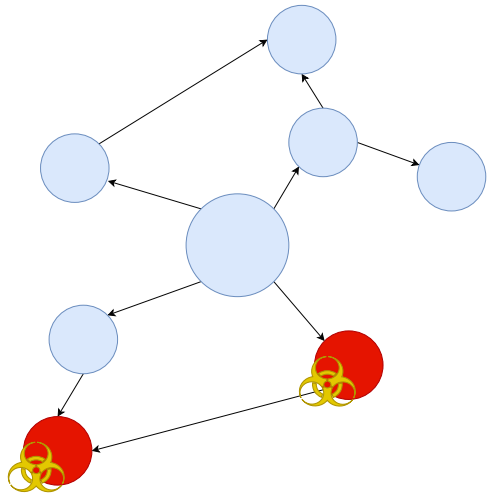

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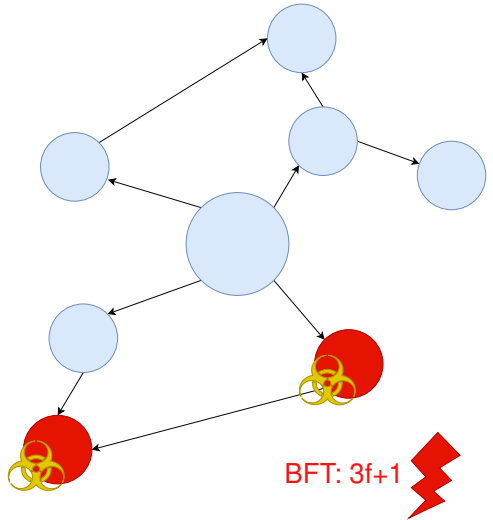

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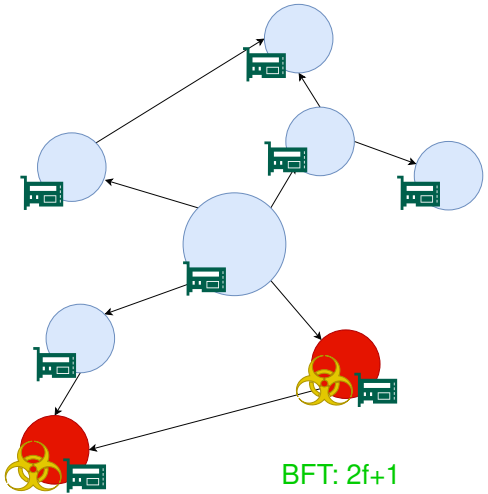
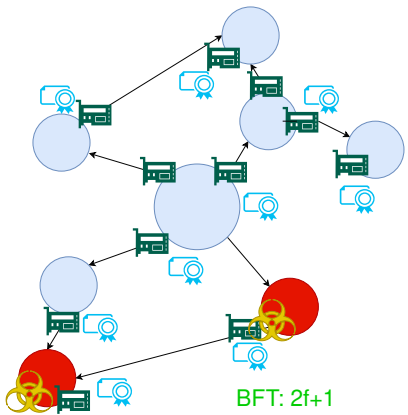


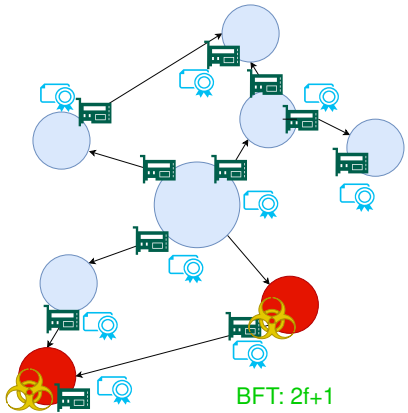
Our Proposal

- ensure BFT via **Kernel Functions** in s-NIC on NW path



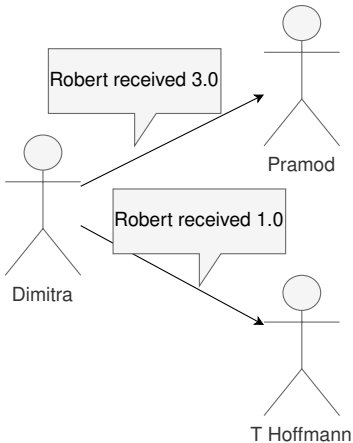
Our Proposal

- ensure BFT via **Kernel Functions** in s-NIC on NW path
- prevent **equivocation** and enable **transferable authenticity**



Challenges: Equivocation

- making conflicting statements



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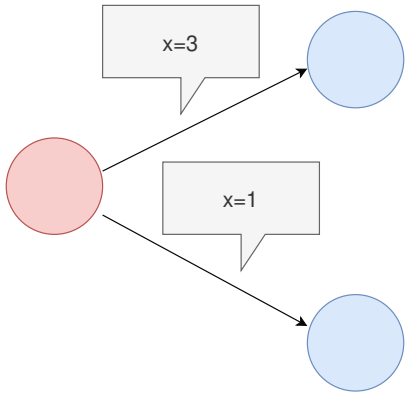
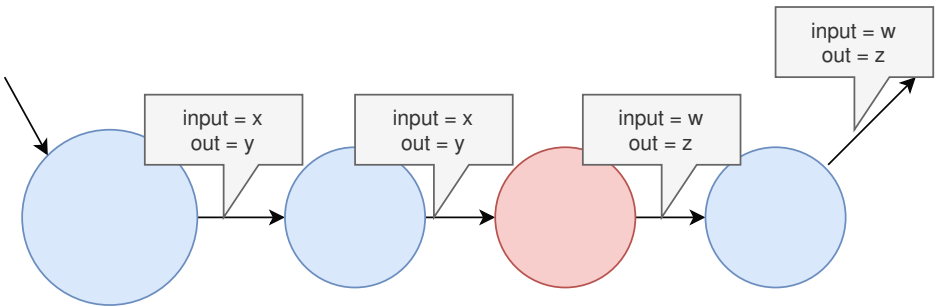


Challenges: Transferable Authenticity

- allow for transitive authentication via PKI



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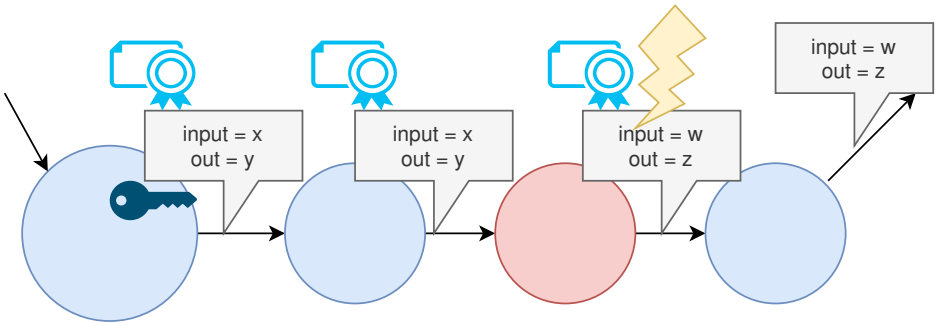
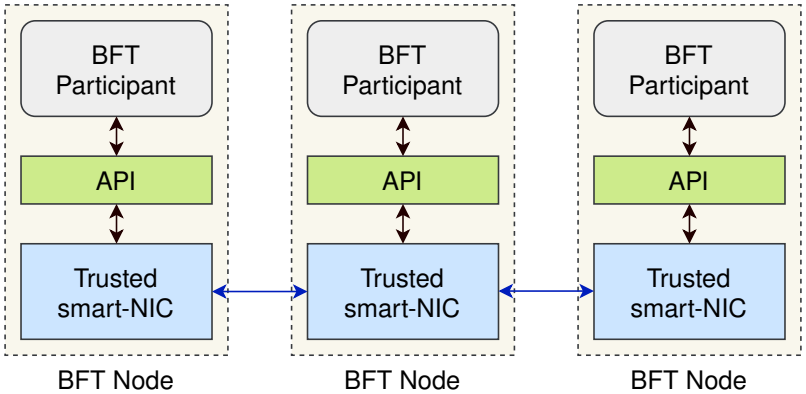


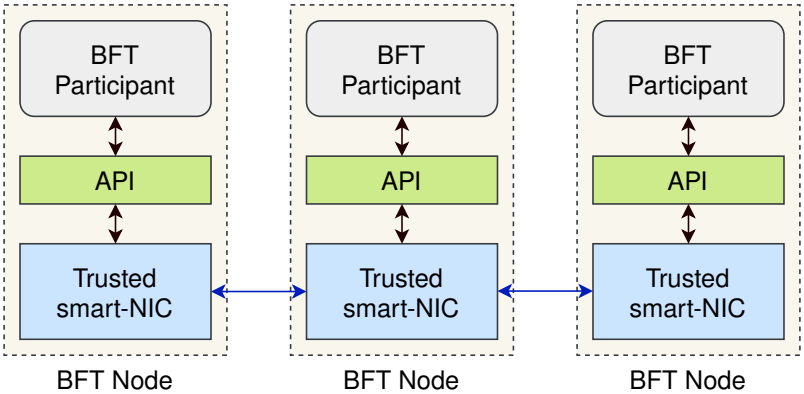
System Overview

- Host and trusted smart-NIC are **separate**



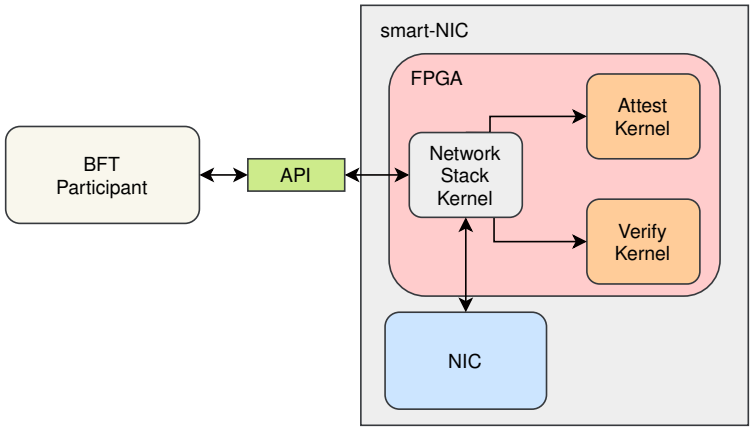
System Overview

- Host and trusted smart-NIC are **separate**
- smart-NIC is on the **network path**



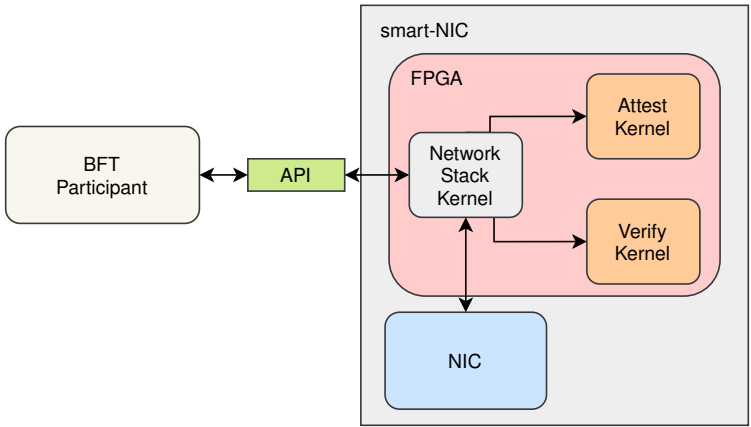
System Layout

- kernel functions: **Attest** and **Verify** Kernels



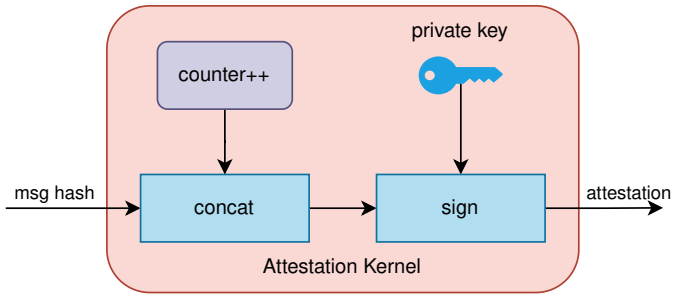
System Layout

- kernel functions: **Attest** and **Verify** Kernels
- Network Stack Kernel: **combines** components



Kernel Function: Attest

- input: **message hash** (SHA-256 32B hash)



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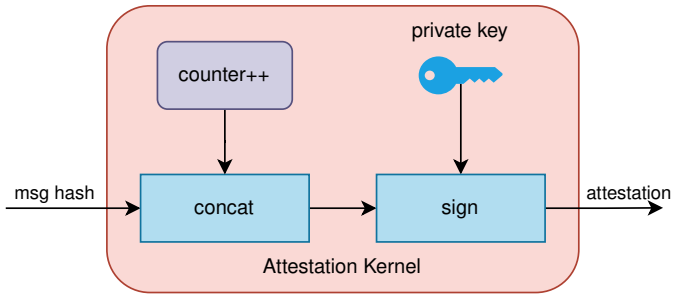

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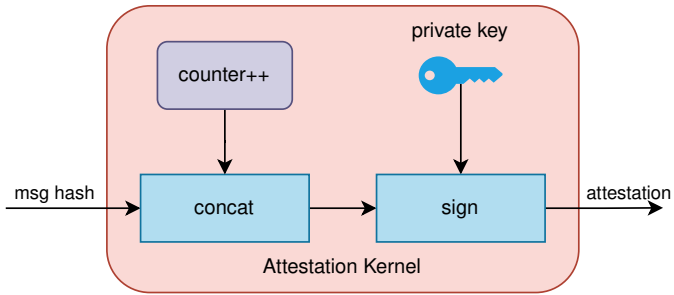

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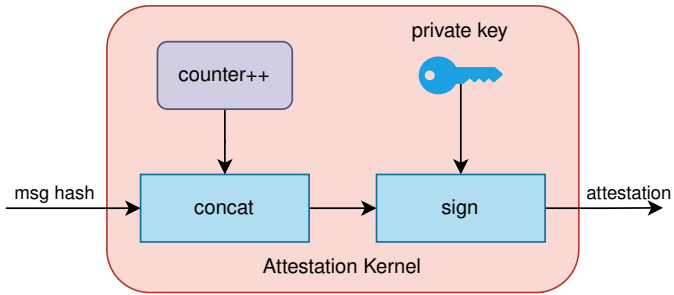

Kernel Function: Verify

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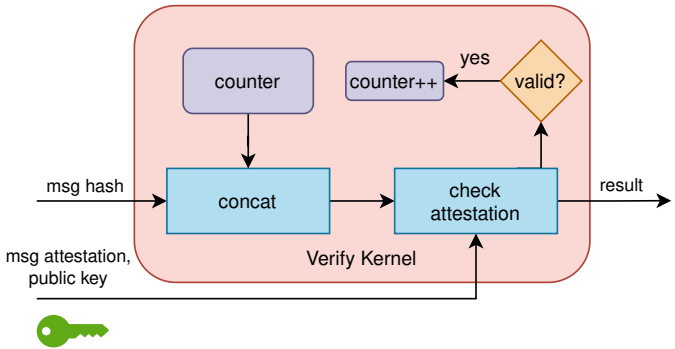

Kernel Function: Verify

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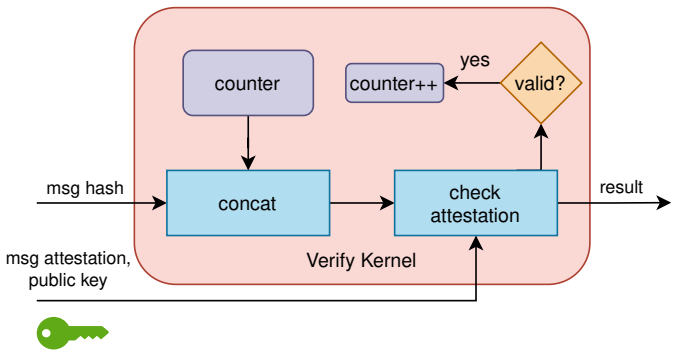

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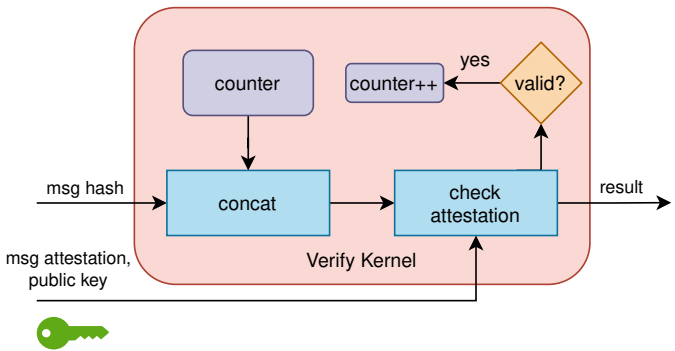
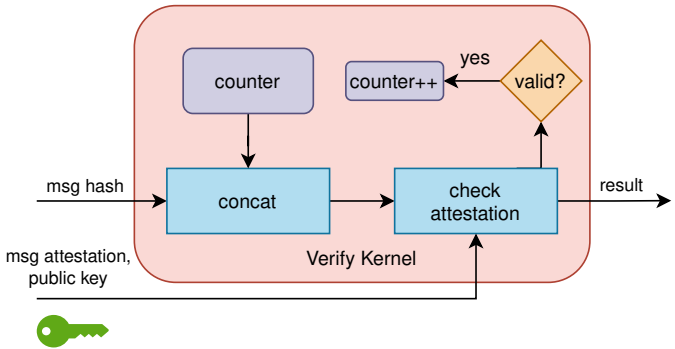


Kernel Function: Verify

- analog to attest
- receives candidate **message hash** and **attestation**
- pre-provided with **public key**
- own **counter** to track count of valid messages



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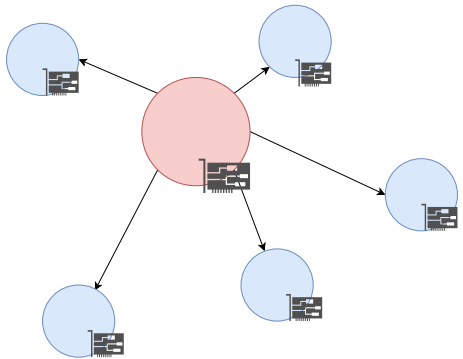

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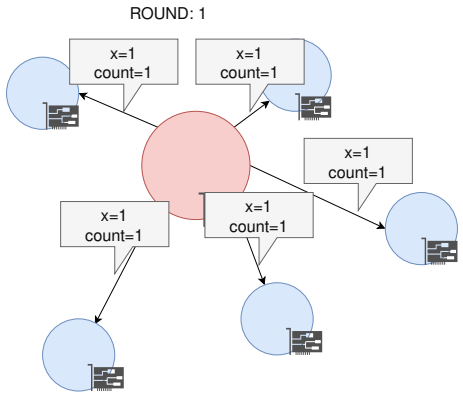

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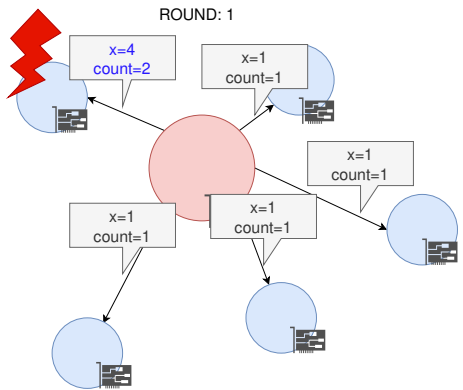

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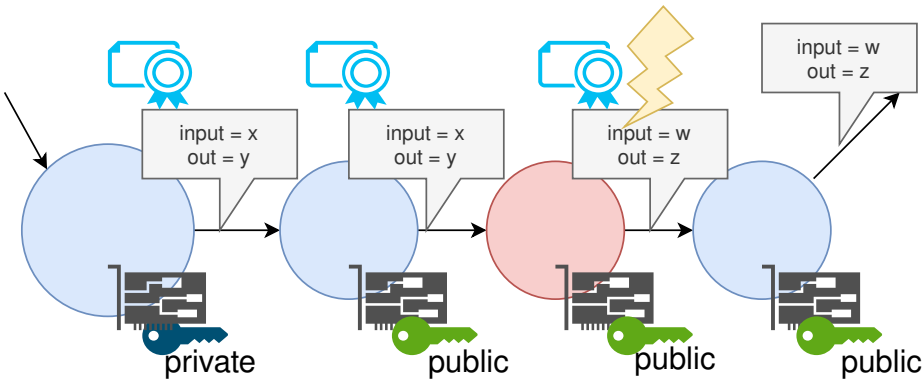

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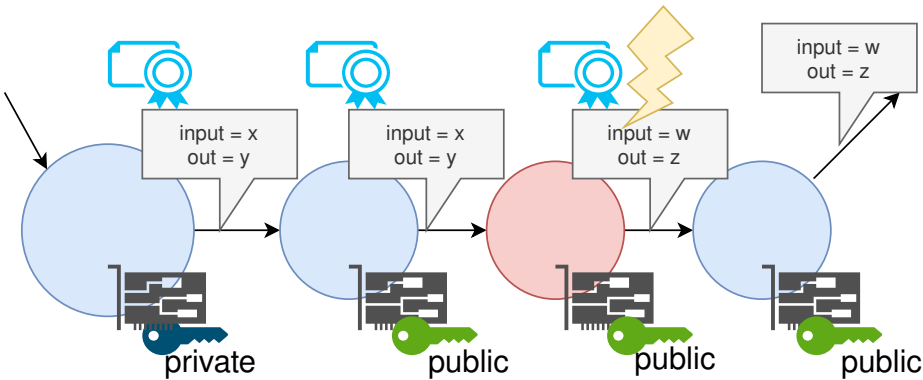

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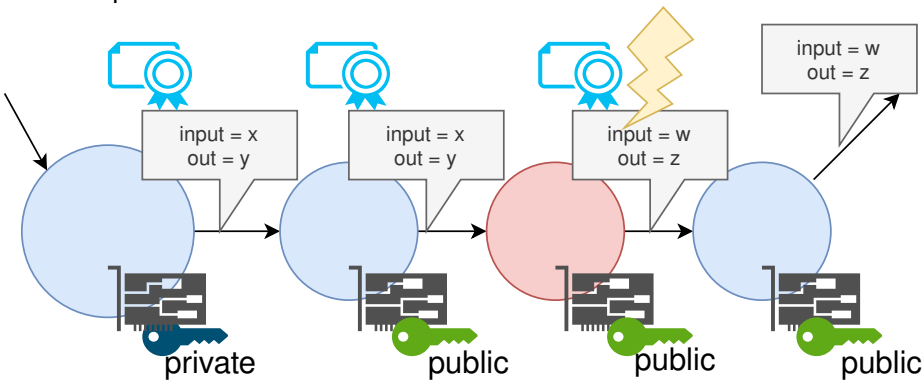
- e.g.: chain replication



Evaluation
Attestation

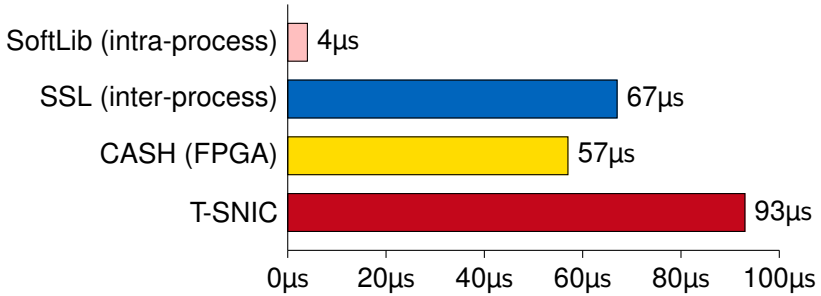


Figure 1 Subsystem Attest Benchmark Comparison

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Verification

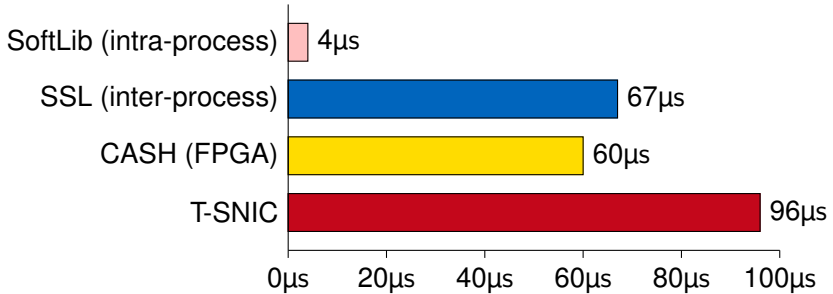

Figure 2 Subsystem Verify Benchmark Comparison

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