Verifying Security Protocols End-to-End with Owl

Joshua Gancher
Carnegie Mellon University

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- TLS, WireGuard, Signal, …
- Supports **verified implementations**

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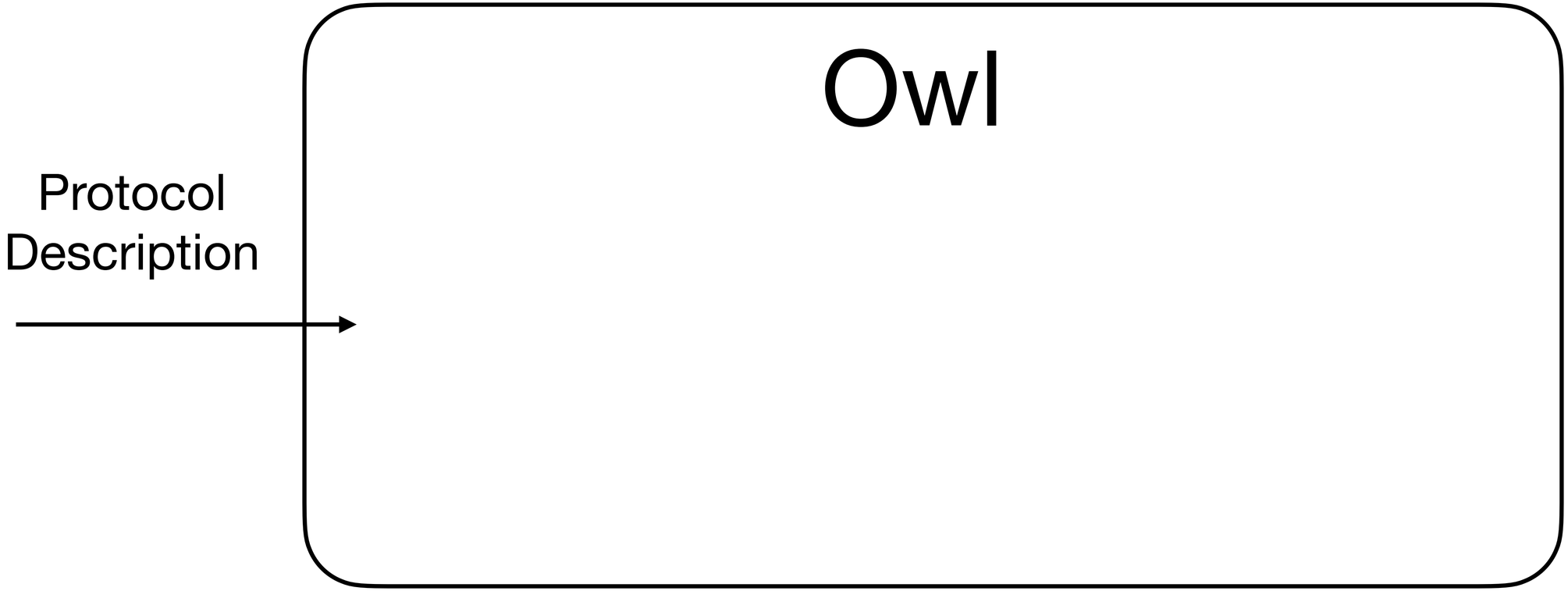
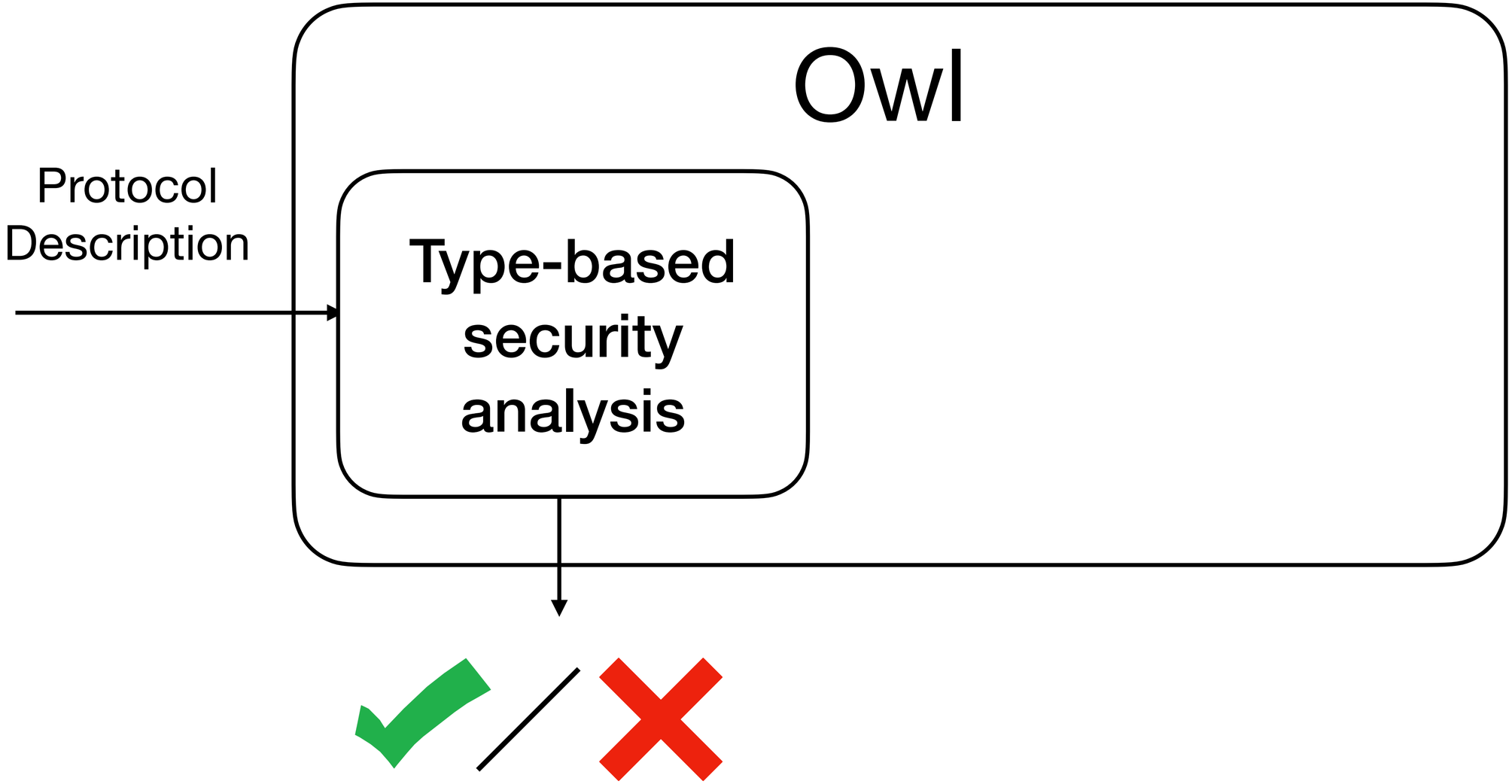
replacements of protocol implementations

- functional correctness
- memory safety
- secure designs


Owl
Protocol
Description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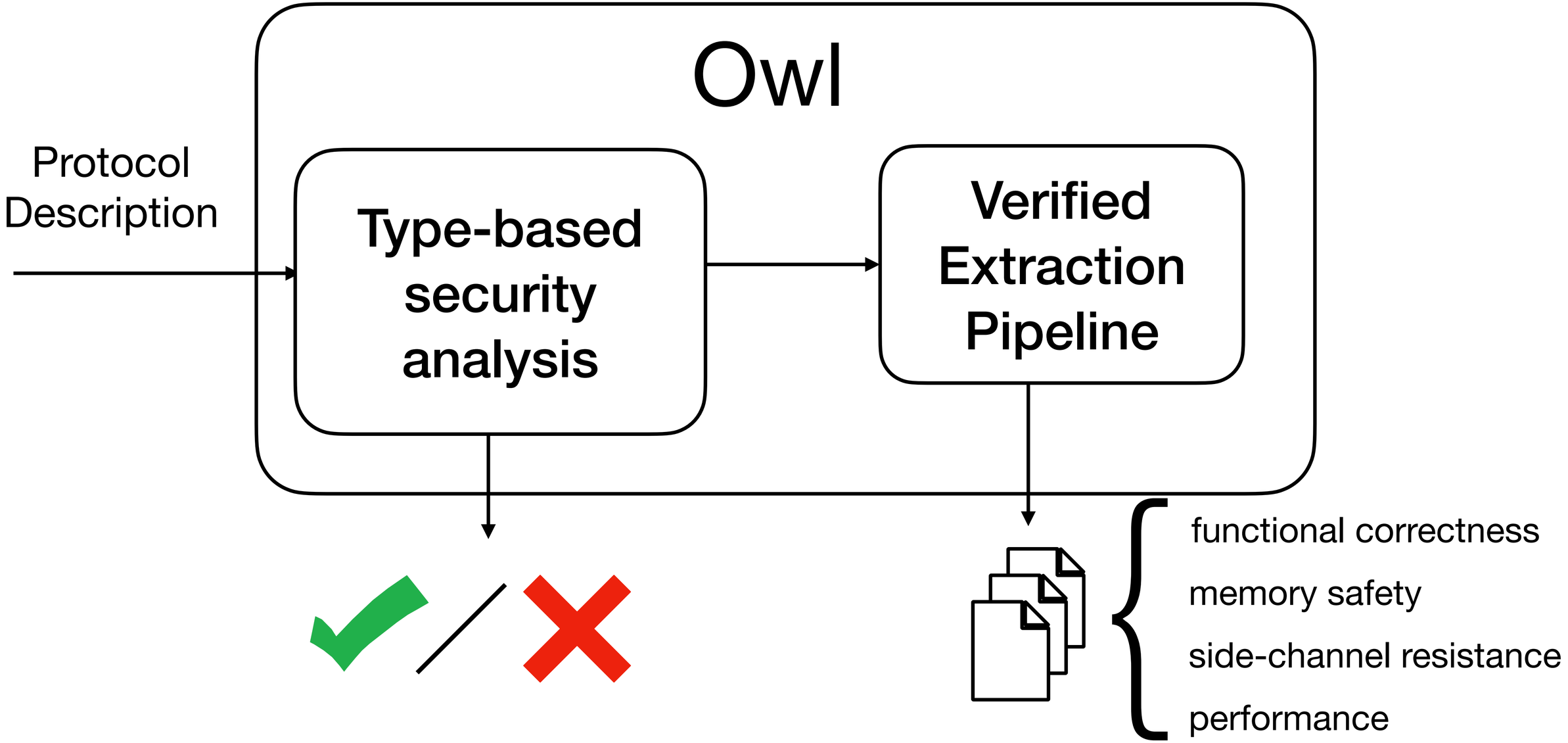
Protocol Description
Type-based security analysis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Protocol Description
Type-based security analysis
Verified Extraction Pipeline
functional correctness
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side-channel resistance
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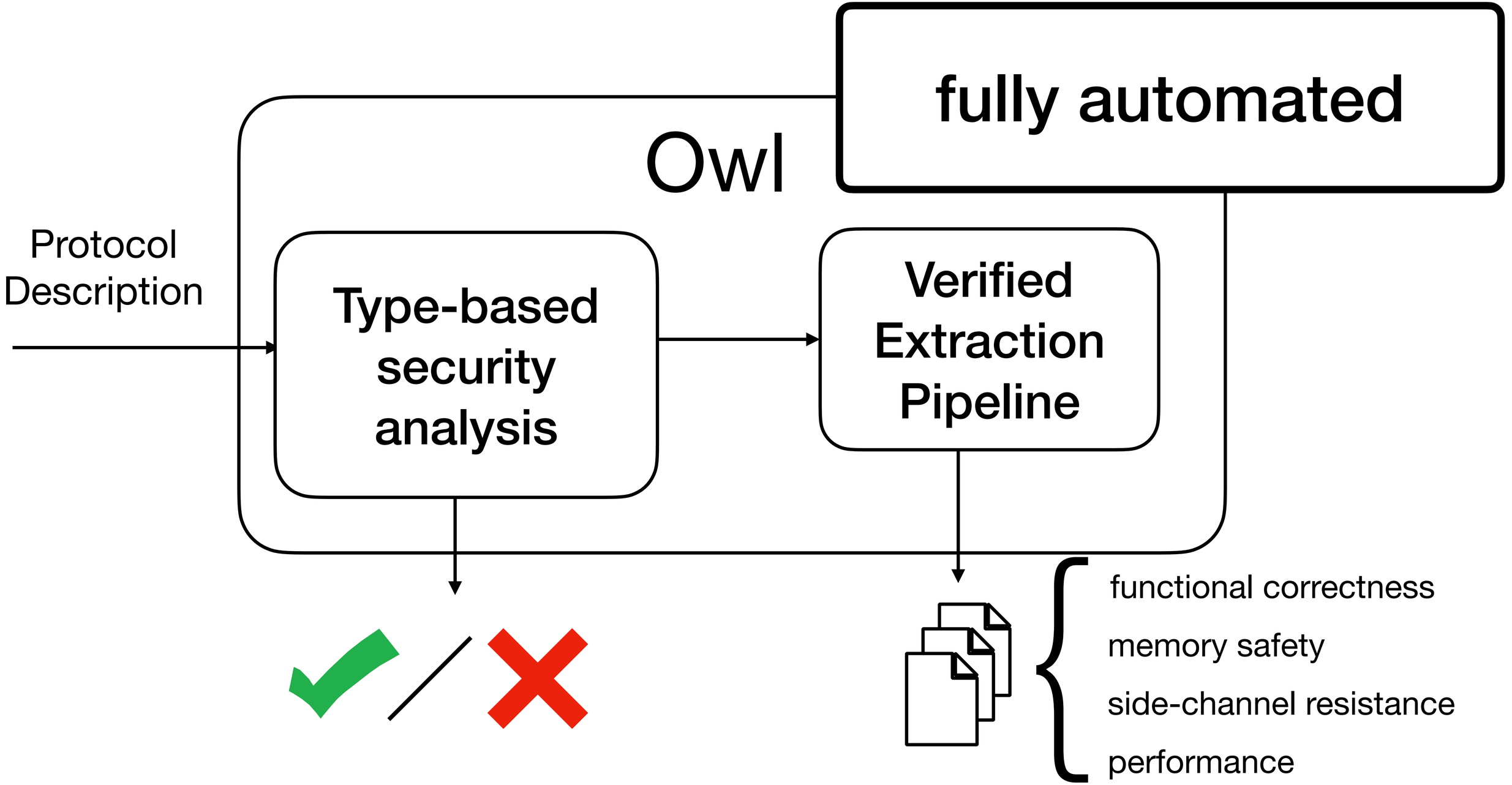
fully automated
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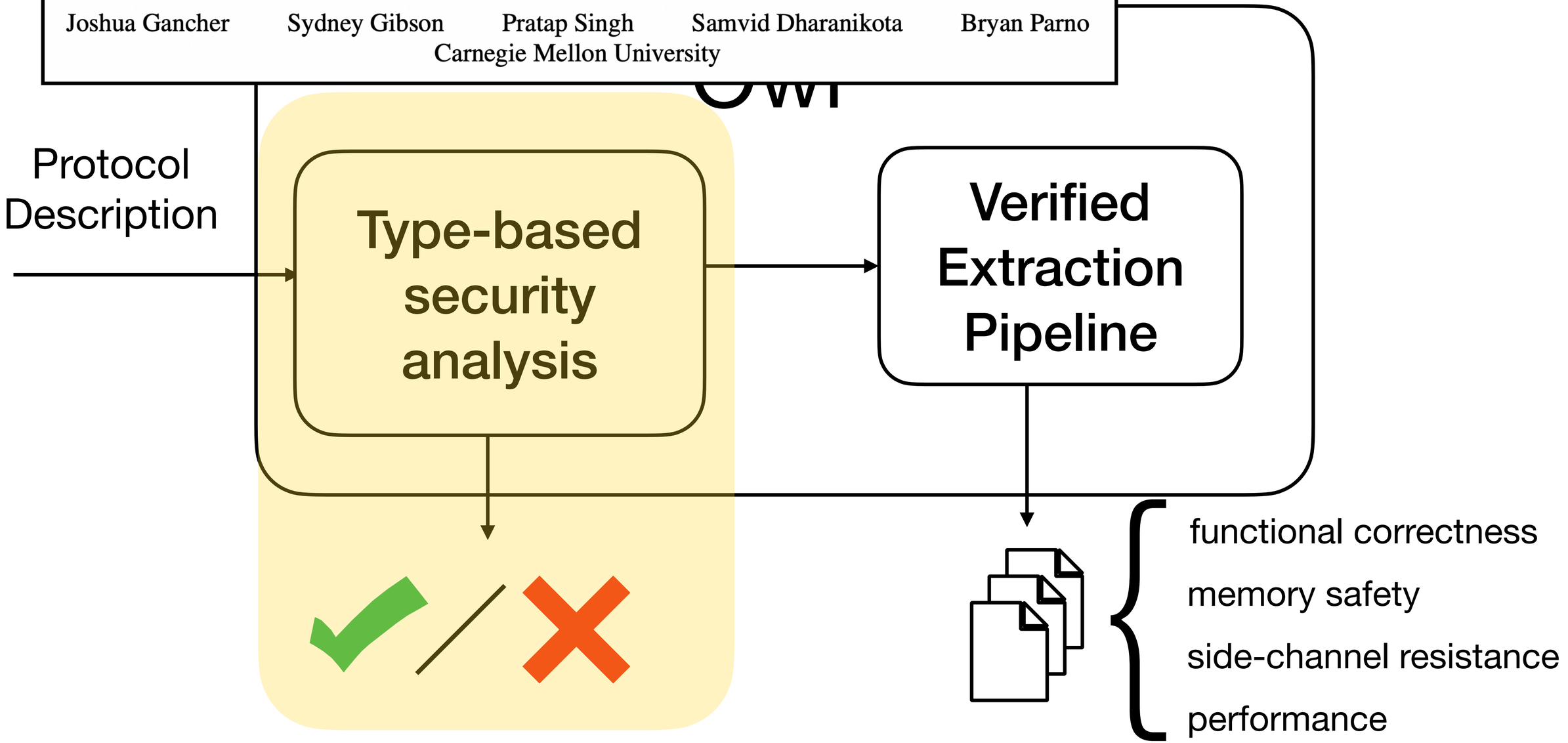
OWL: Compositional Verification of Security Protocols via an Information-Flow Type System

Joshua Gancher Sydney Gibson Pratap Singh Samvid Dharanikota Bryan Parno
Carnegie Mellon University



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Computational Security

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Crypto modeled by
abstract terms,
equations on functions

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Strong attacker model;
closer to implementations

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$m : T$

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$\longrightarrow$

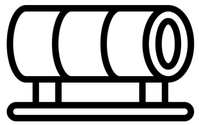
automatic, modular proof effort

Protocol-Level Modularity

Handshake

+

Data Transfer



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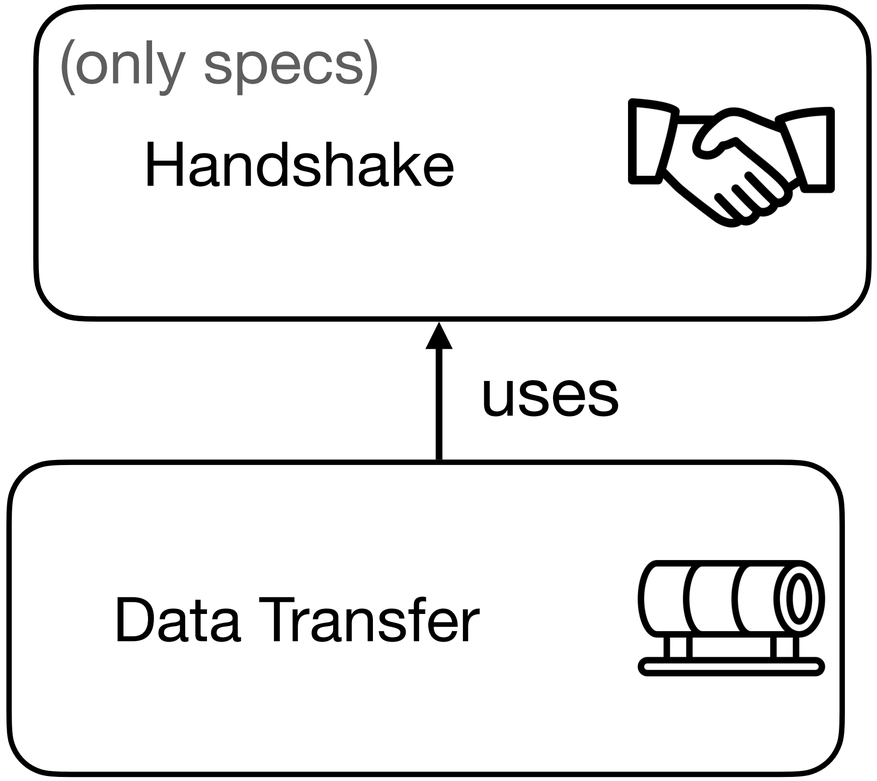

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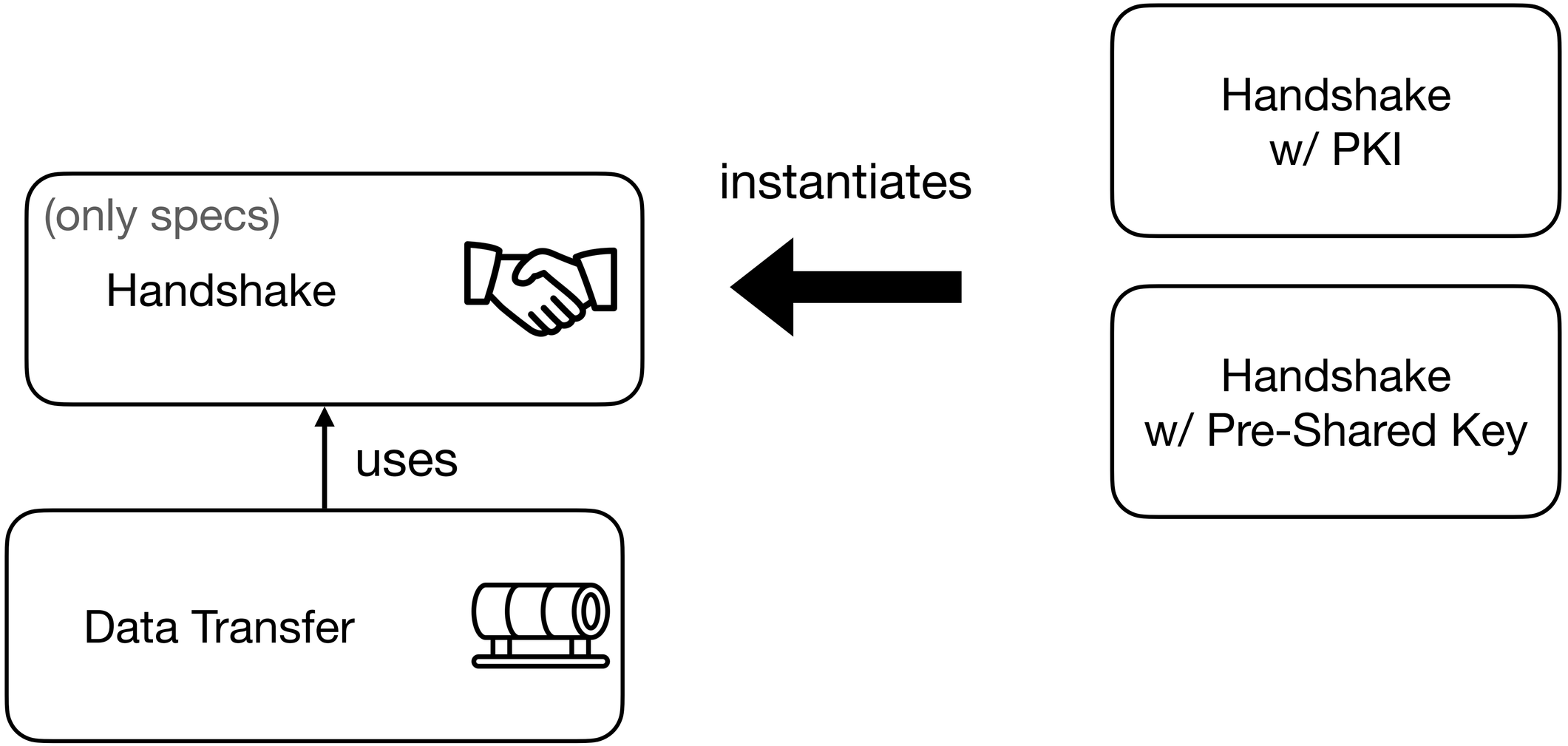

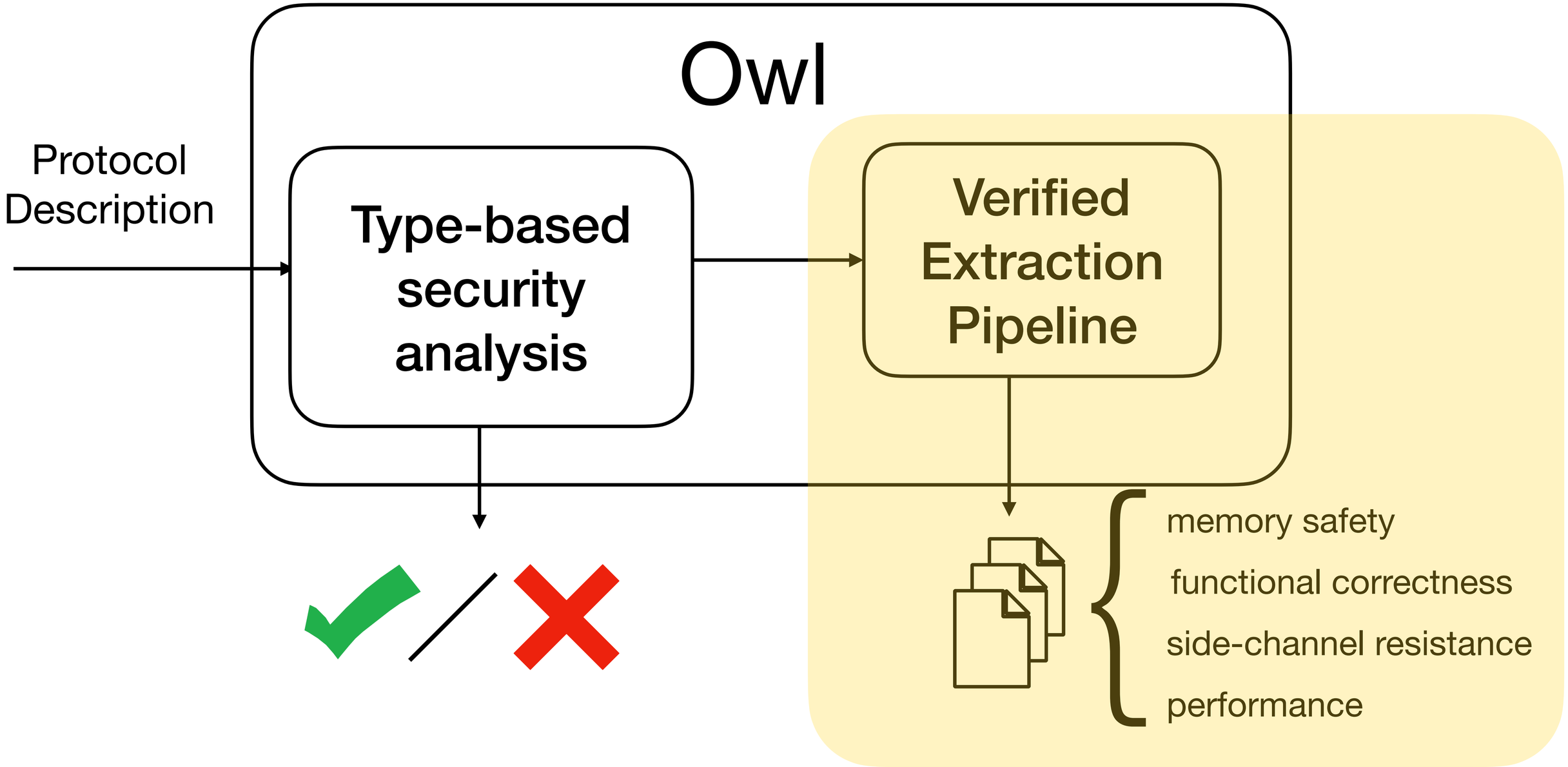
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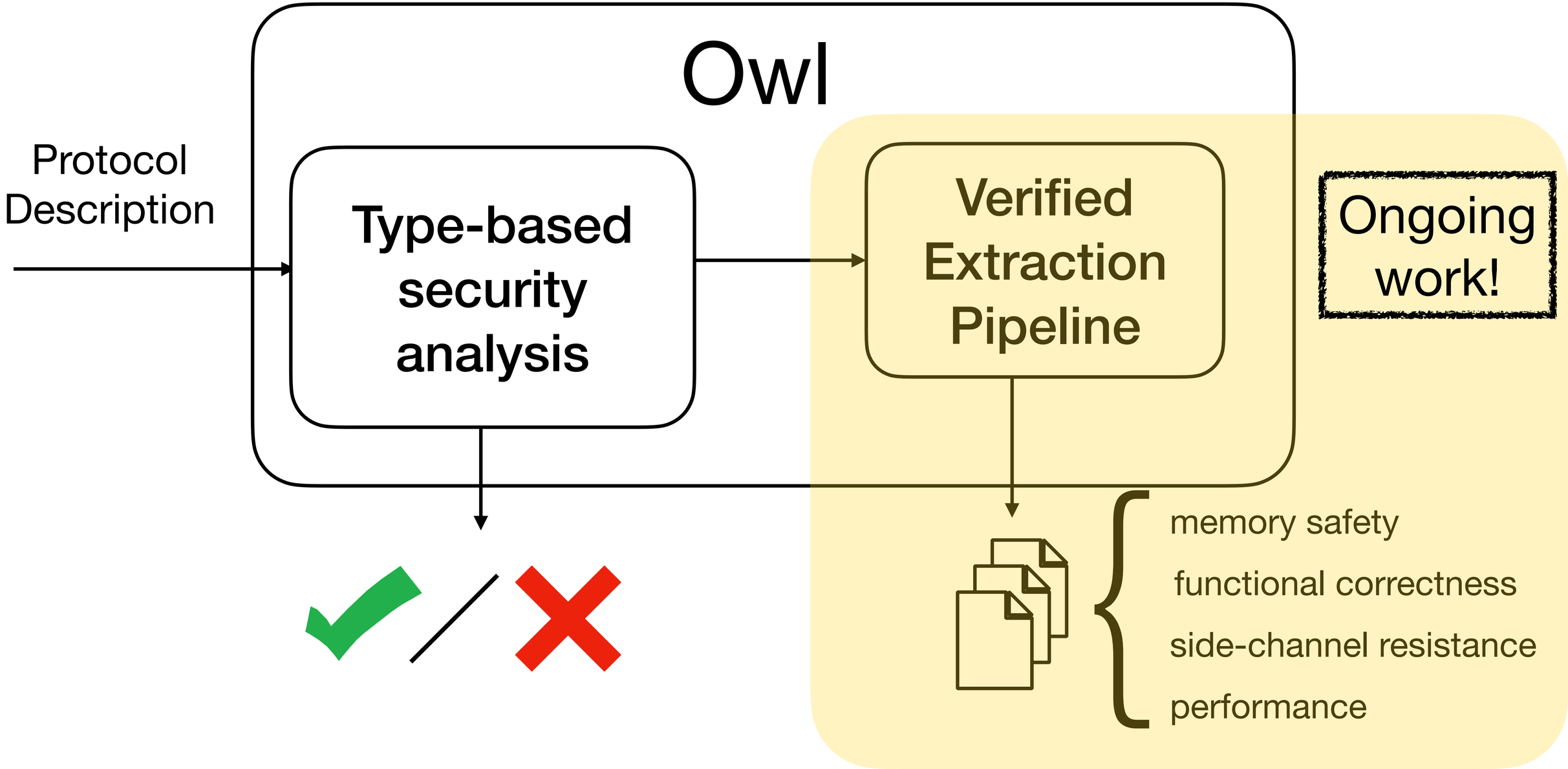
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Ongoing work!
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Verus: Verifying Rust Programs using Linear Ghost Types

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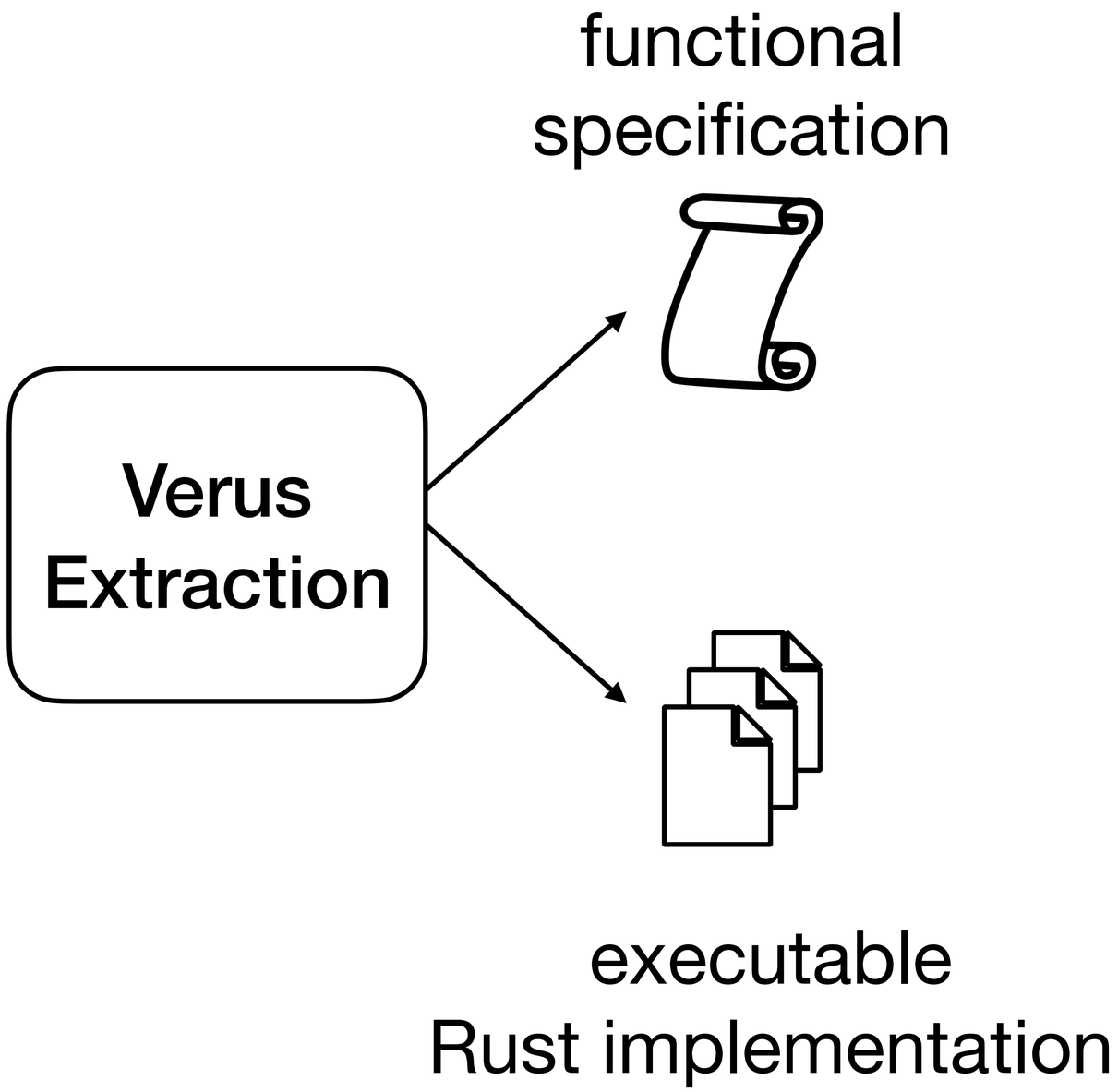
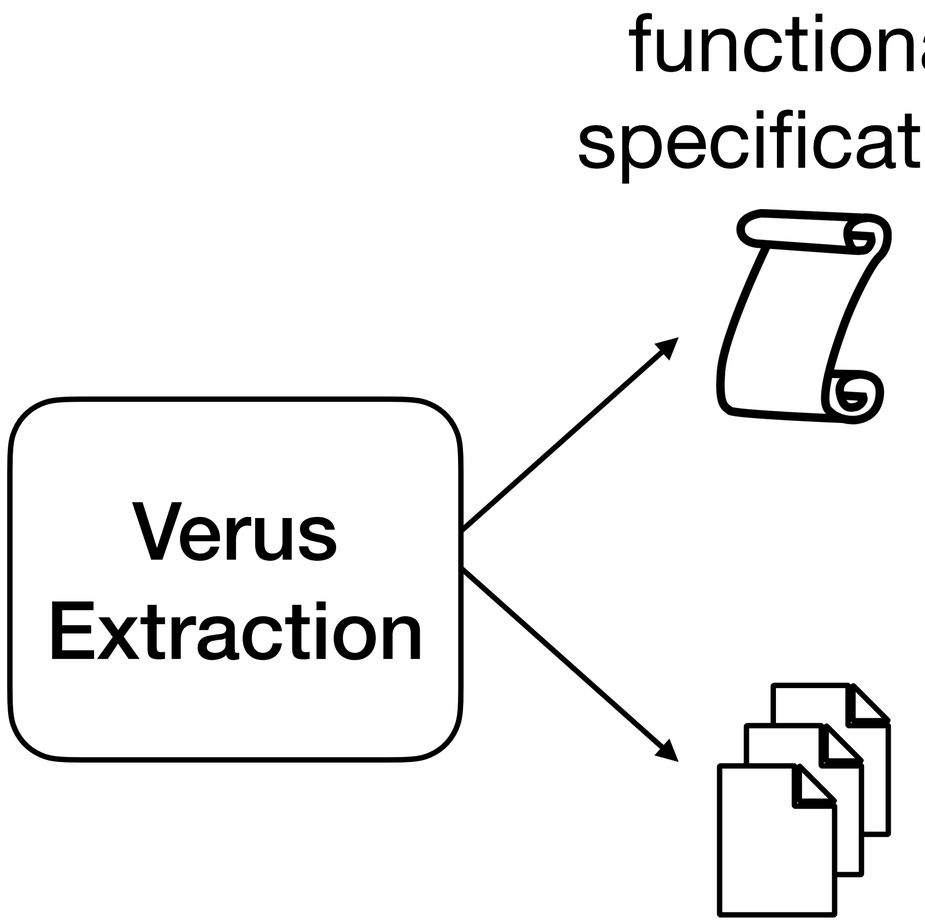


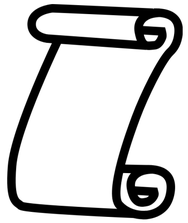
Verus: Verifying Rust Programs using Linear Ghost Types



(almost) **directly equal** to input
Owl code

Verus: Verifying Rust Programs using Linear Ghost Types

functional specification



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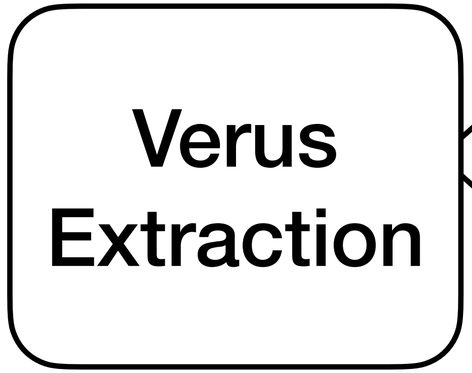
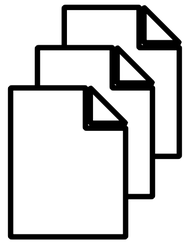


gory low-level details

verified parser library,

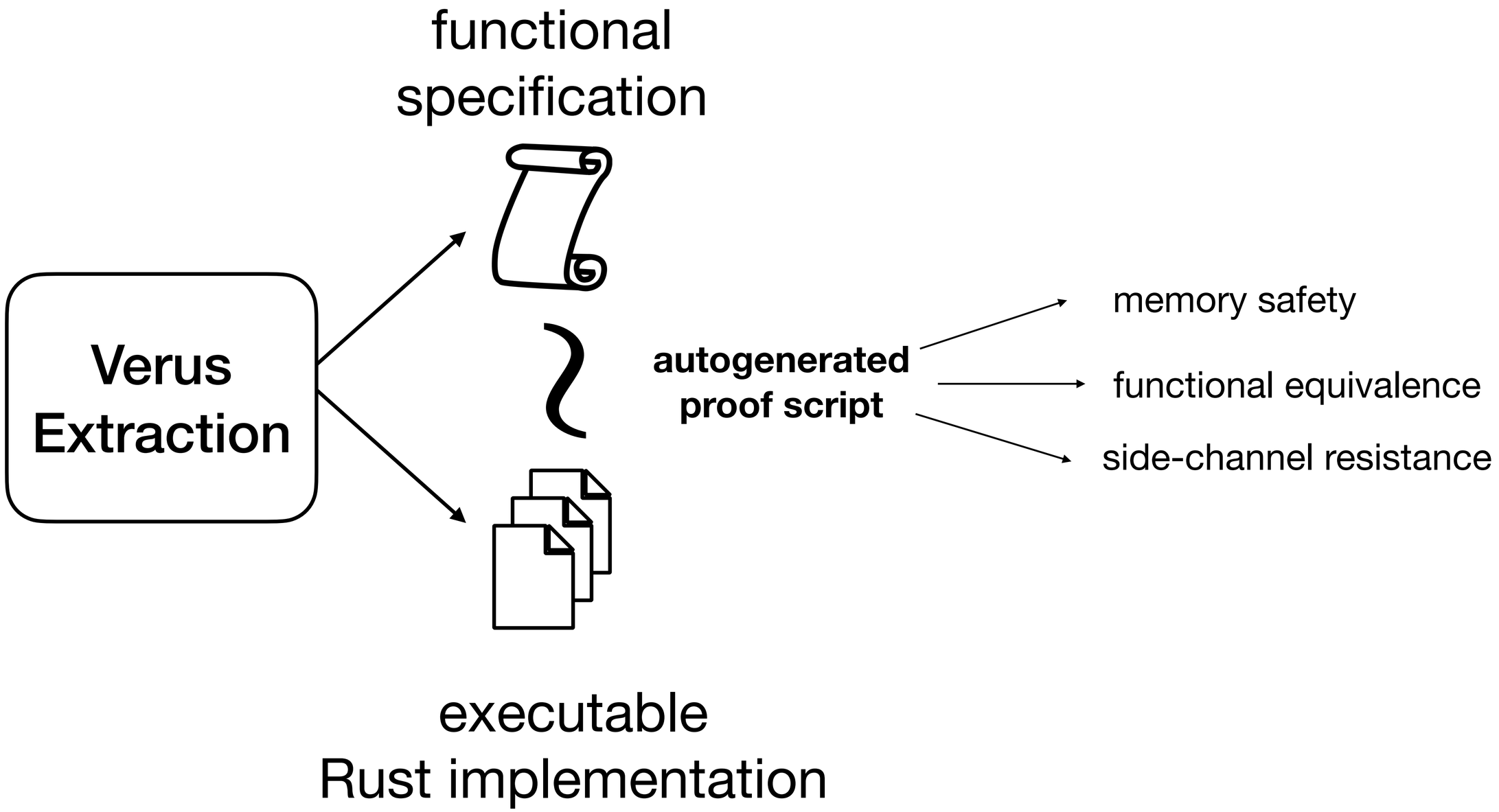
zero-copy ciphers,

...



executable Rust implementation

Verus: Verifying Rust Programs using Linear Ghost Types



Ongoing Work: a verified VPN

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Goal: verified, drop-in replacement

Owl:
End-to-End Verification of Security Protocols via a Secure Type System

New tool for **modular**, **automated** proofs of security protocols

- Novel use of **type systems** for constructing secure cryptographic protocols
  - Security is proved once-and-for-all;
  - Protocols checked **via type checker**
- Ongoing work: **verified extraction** and drop-in implementation of WireGuard

owl-lang.org

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