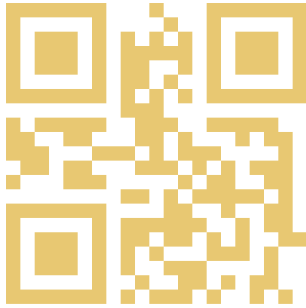


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Zero-knowledge-proofs - part 1

ENGINEERING WORKSHOP - DEC 2025
(IRELAND)

typst

$$\nabla \cdot \mathbf{E} = \rho \quad (15)$$

Let \mathbf{E} be given by

$$\mathbf{E} = \frac{1}{\epsilon_0} \nabla \phi \quad (16)$$

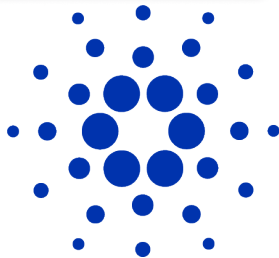
Let them feed into the seen channel to be quadratic in the field tensor because we want to derive a linear field equation in which the interpolation theorem holds. The action has to be a scalar, the simplest quadratic scalar of the field tensor is the product given in Eq. (20).

$$\left(\begin{array}{ccc} E_1 & -E_2 & 0 \\ E_2 & E_1 & -E_3 \\ 0 & E_3 & 0 \end{array} \right)$$

The three spatial components of \mathbf{E} , (20)

yield the magnetic induction law

$$\nabla \times \mathbf{B} = \frac{1}{c} \frac{\partial \mathbf{E}}{\partial t} + \frac{1}{c} \mathbf{j} \quad (26)$$



Pawel Jakubas

Plan of the tutorial

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Let's get a little deeper than usual and understand what main building blocks of ZKP looks like

This tutorial will focus on

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1. sketching the landscape of what we want to understand during 3-4 parts
- 2.

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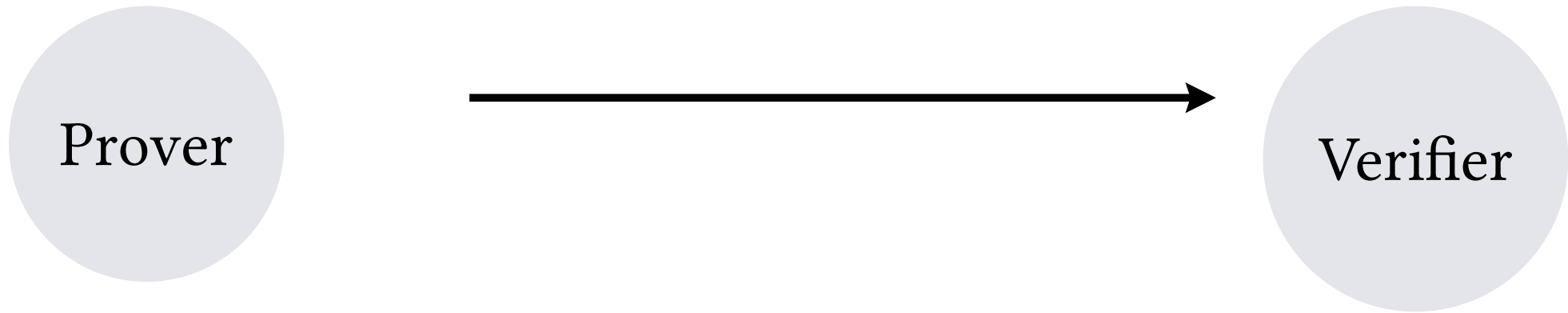
This tutorial will focus on

1. sketching the landscape of what we want to understand during 3-4 parts
2. cover the first part in some detail **elliptic curves**

Verifiable computing vs ZKP (1)

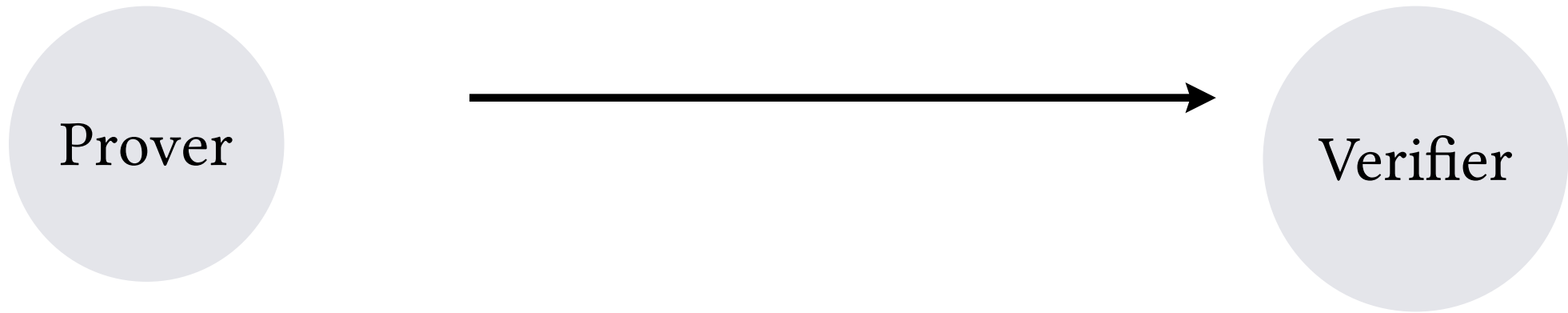
Verifiable computing vs ZKP (1)

There is **asymmetry** built into those systems. It is much easier to get public key from secret. But not the other way



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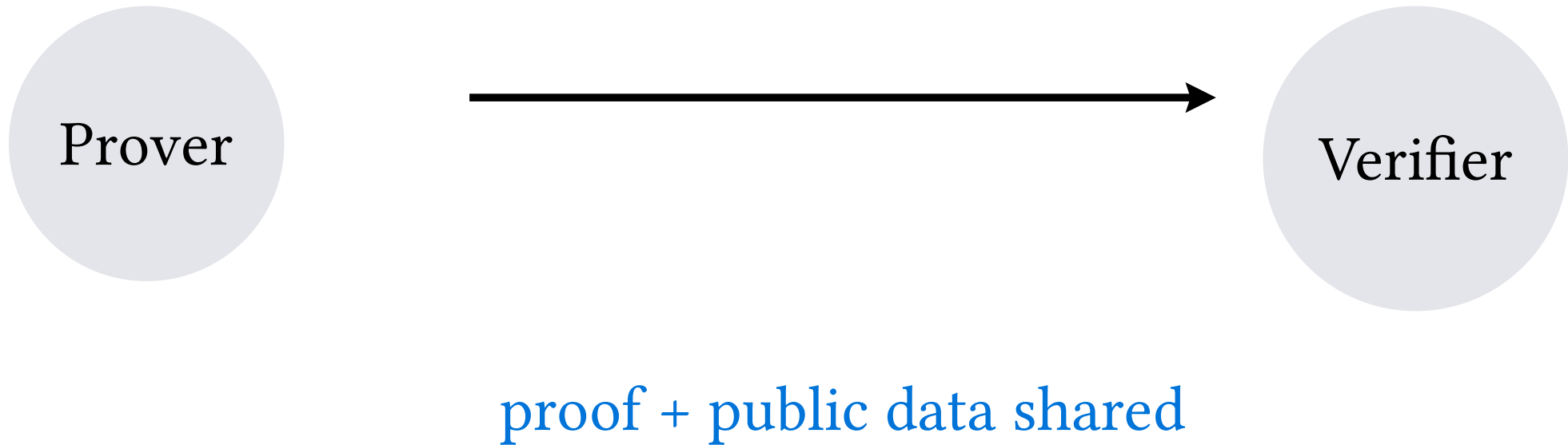
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secret -> (easy) -> public

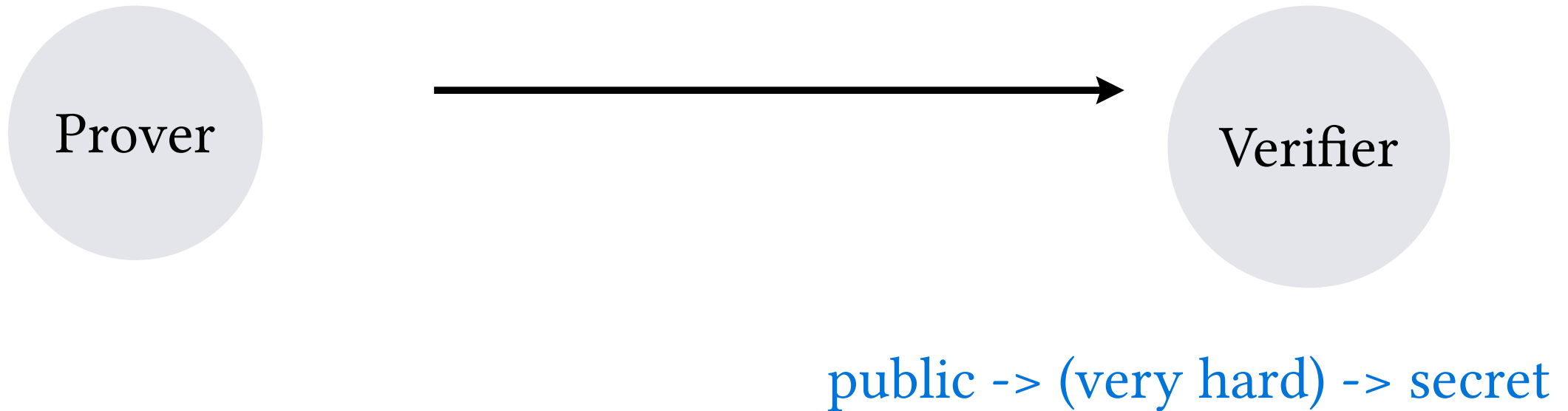
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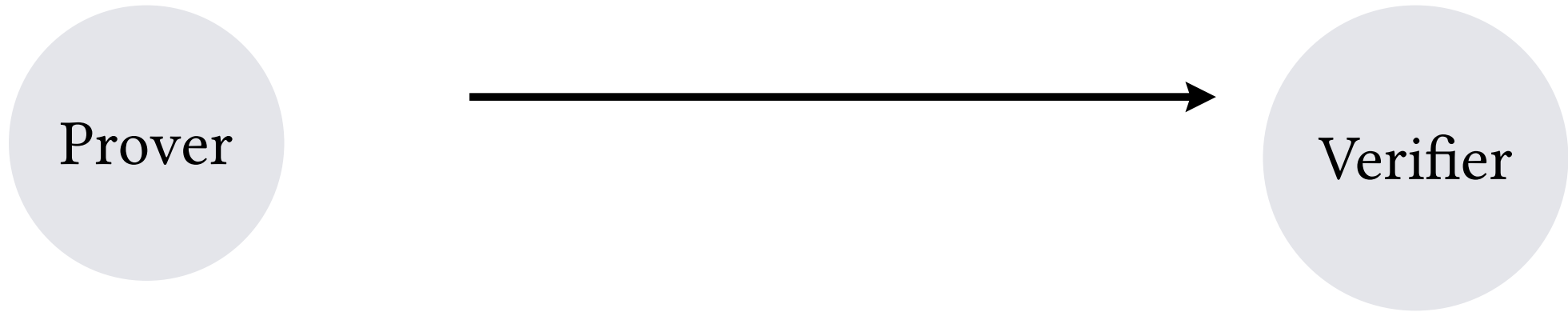
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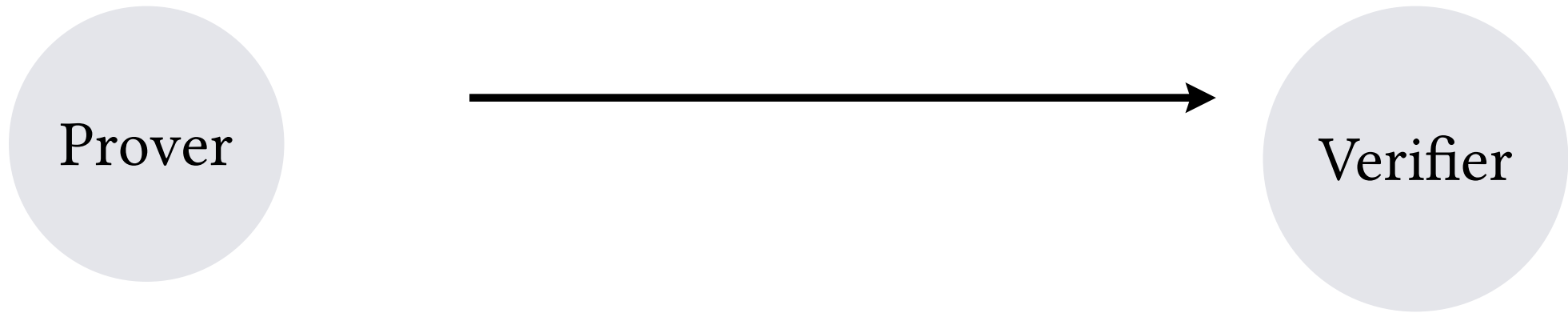
Verifiable computing vs ZKP (2)

There is **asymmetry** built into those systems. It is much quicker to verify than prove something.



Verifiable computing vs ZKP (2)

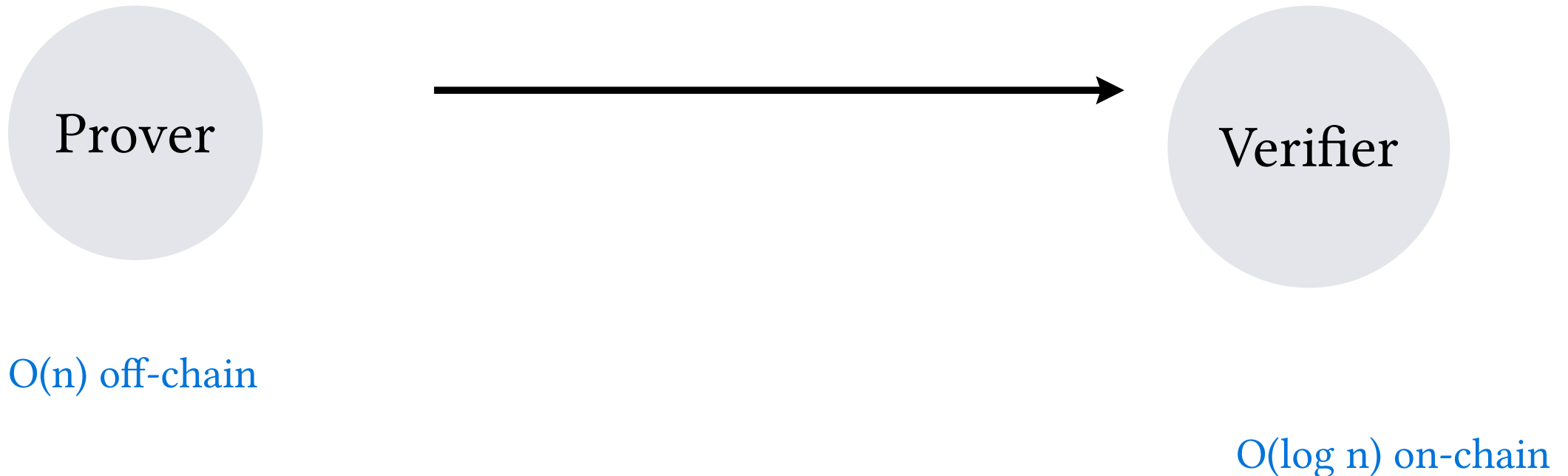
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$O(n)$ off-chain

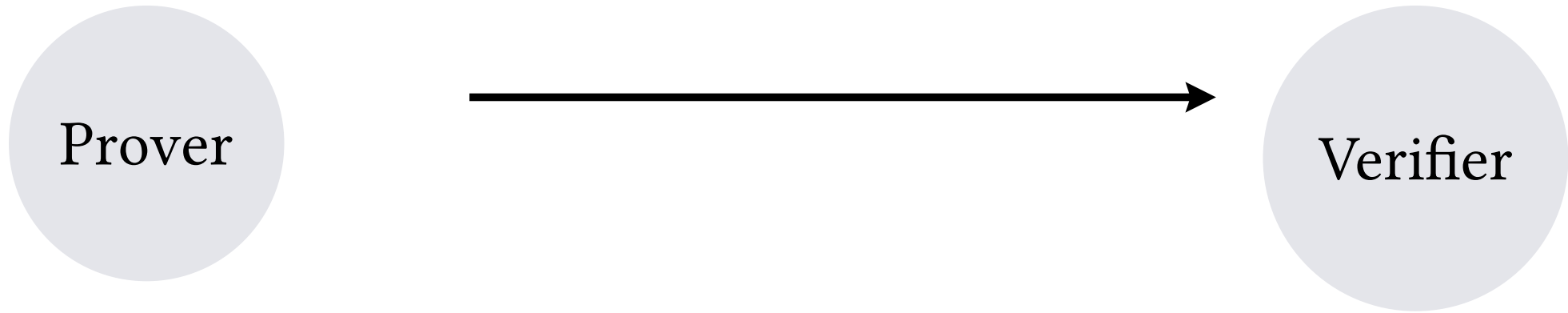
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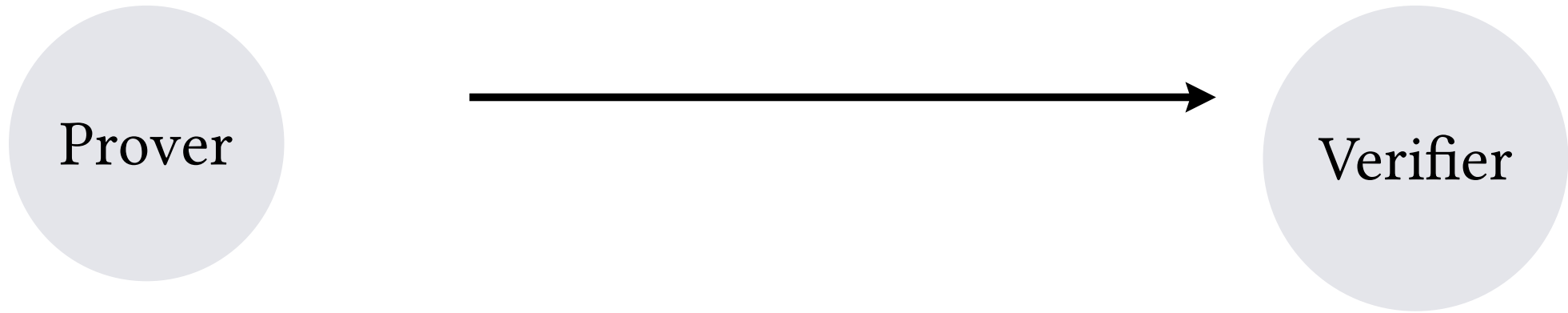
ZKP (3)

Data sent to verifier is compressed, and can be hidden



ZKP (3)

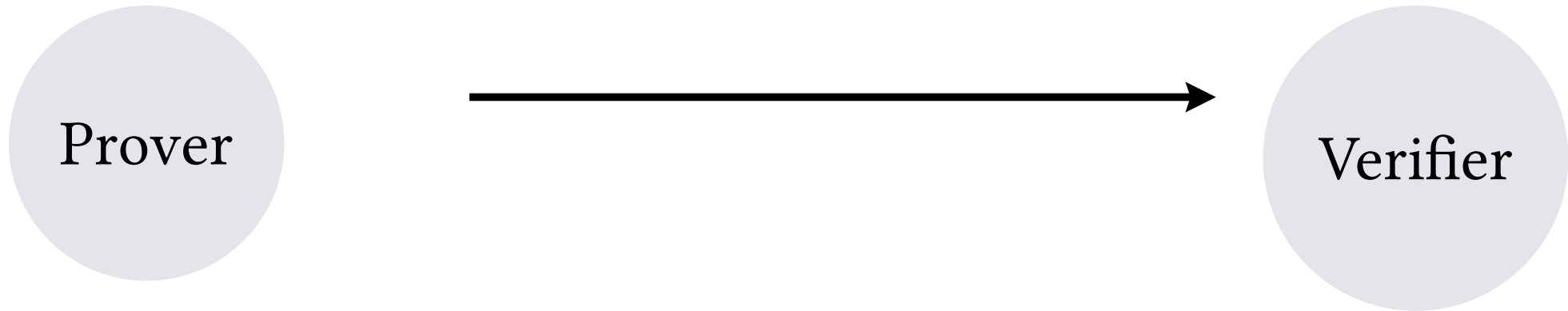
Data sent to verifier is compressed, and can be hidden



size: n

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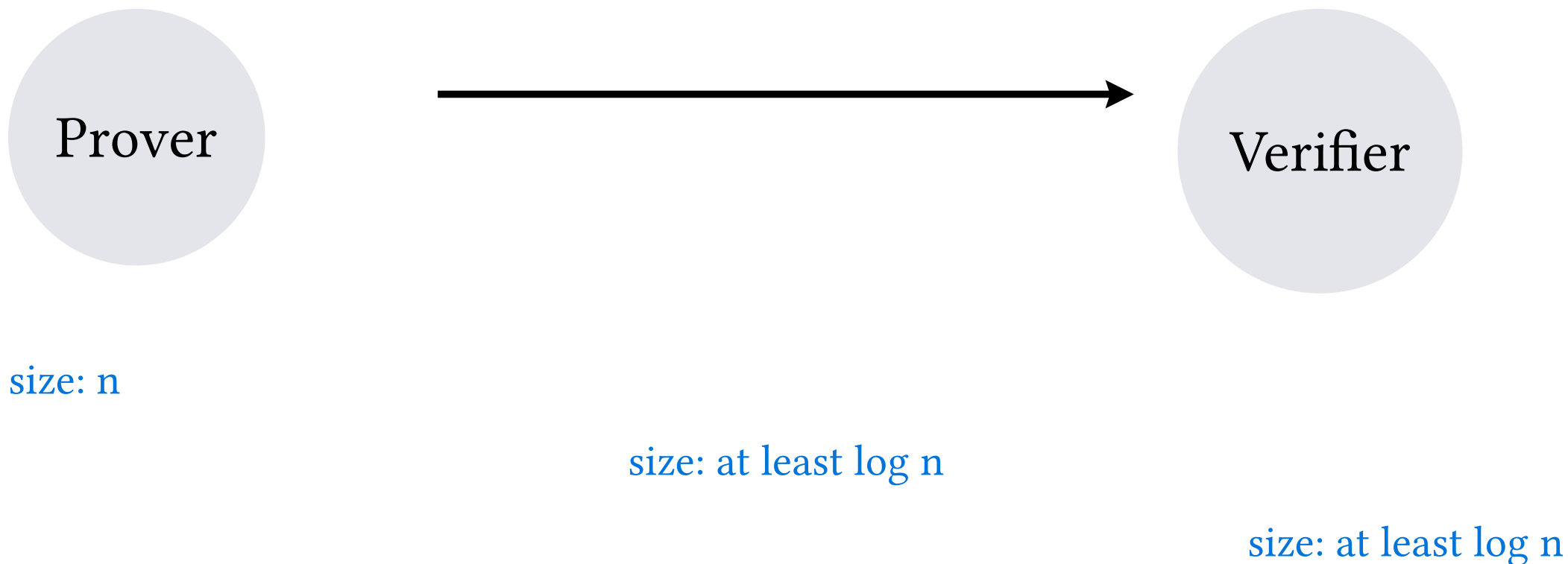


size: n

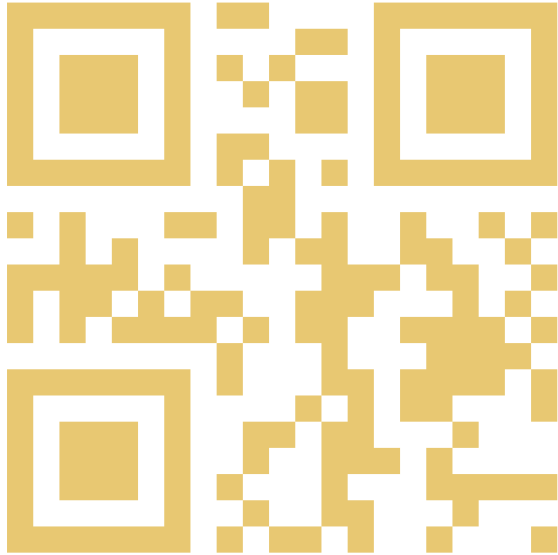
size: at least $\log n$

ZKP (3)

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That's it! More to come in the future



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