

Error-prone cryptographic designs

Daniel J. Bernstein

University of Illinois at Chicago &
Technische Universiteit Eindhoven

*“The poor user is
given enough rope with which
to hang himself—something
a standard should not do.”*

—1992 Rivest,
commenting on nonce generation
inside Digital Signature Algorithm
(1991 proposal by NIST,
1992 credited to NSA,
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Crypto horror story #1

2010 Bushing–Marcan–Segher–
Sven “failOverflow” demolition
of Sony PS3 security system:
Sony had ignored requirement
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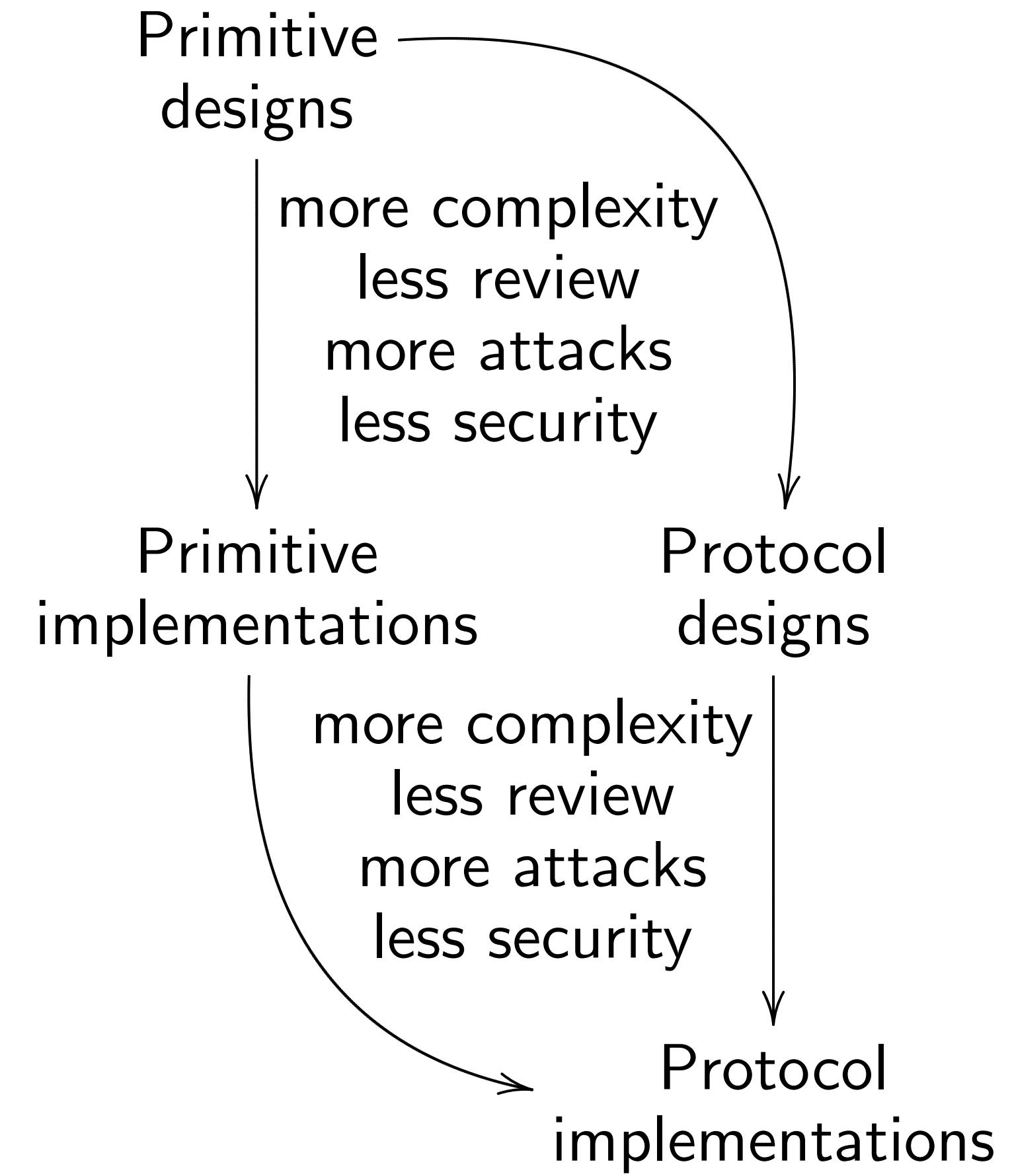
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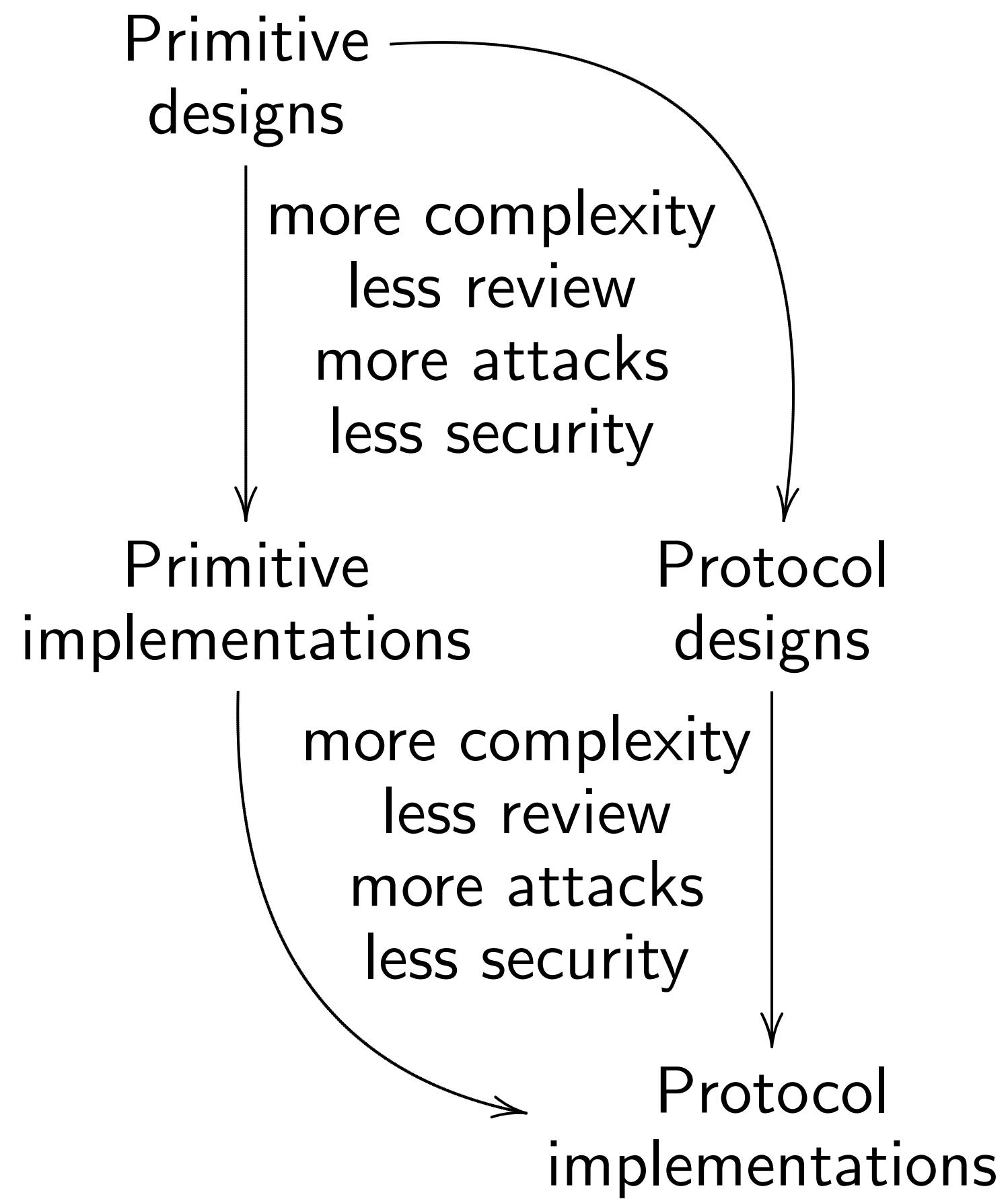
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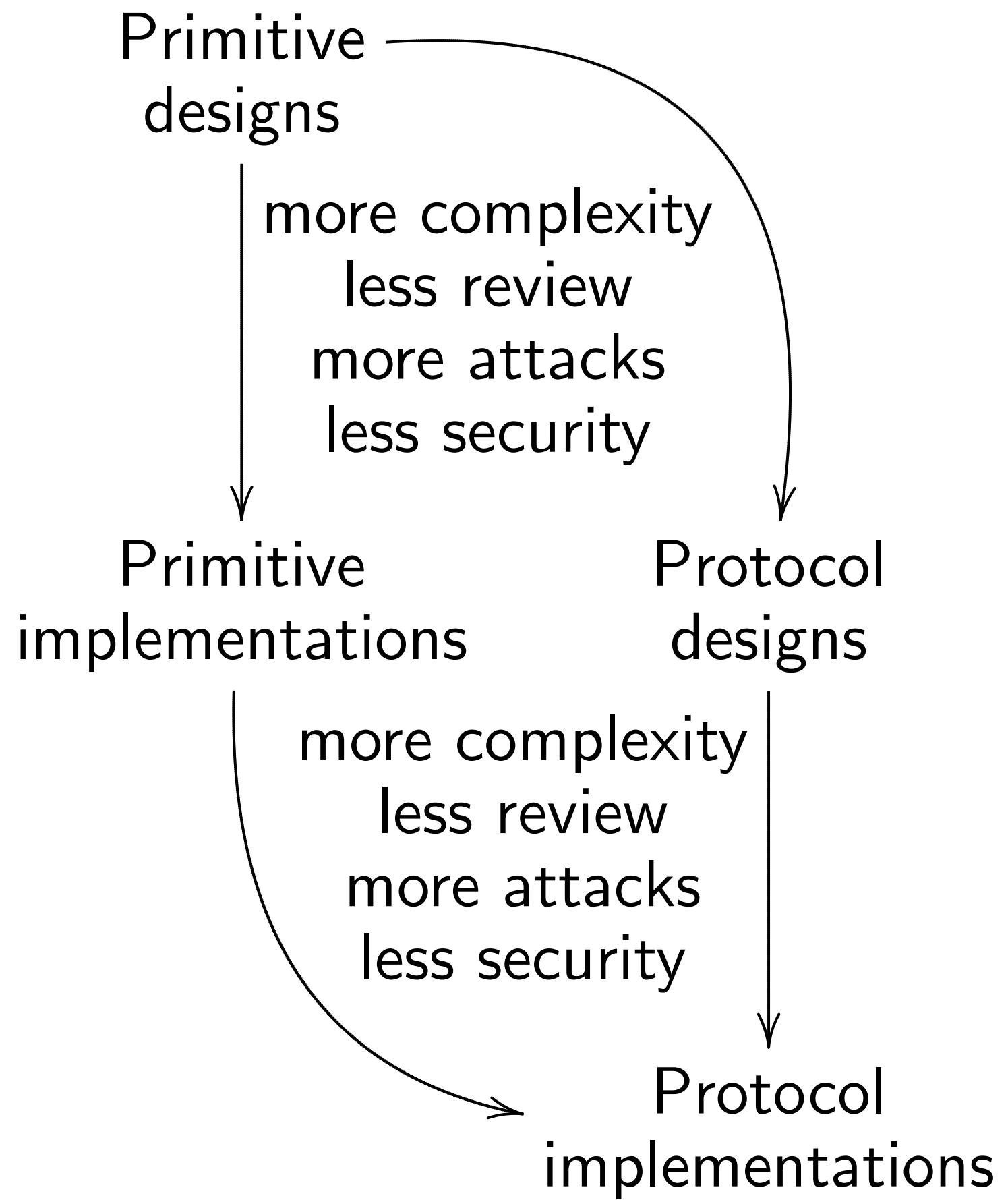
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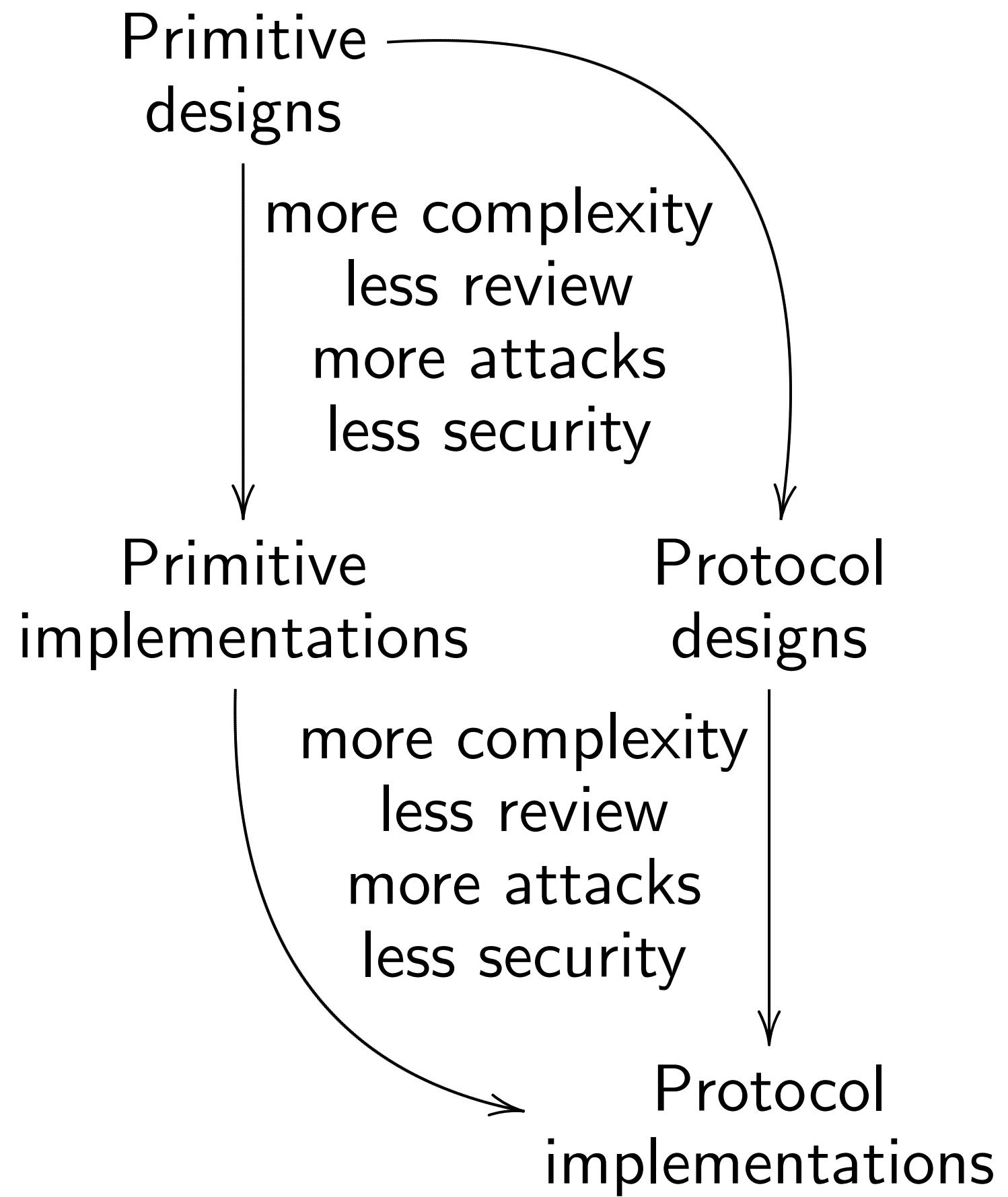
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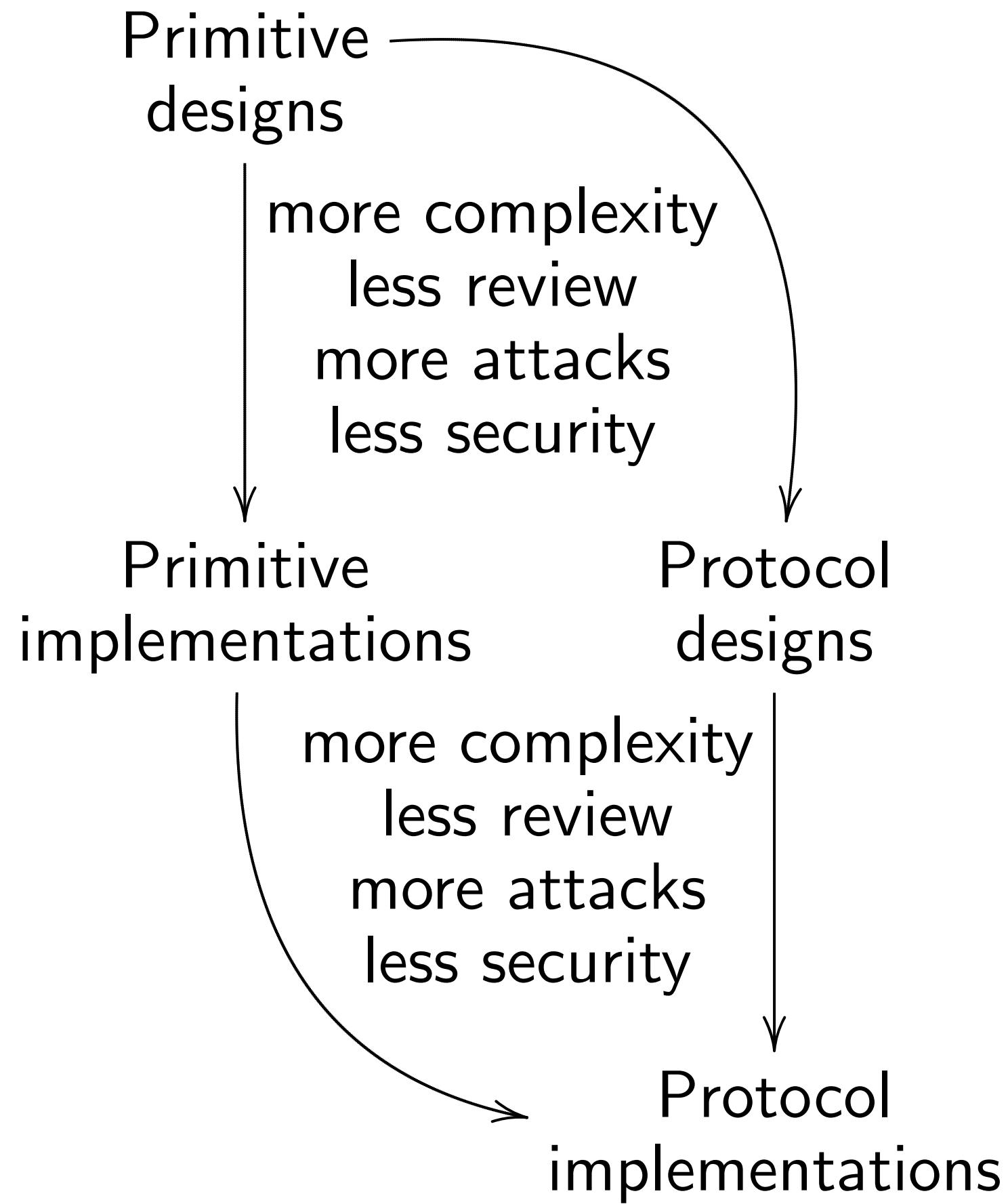
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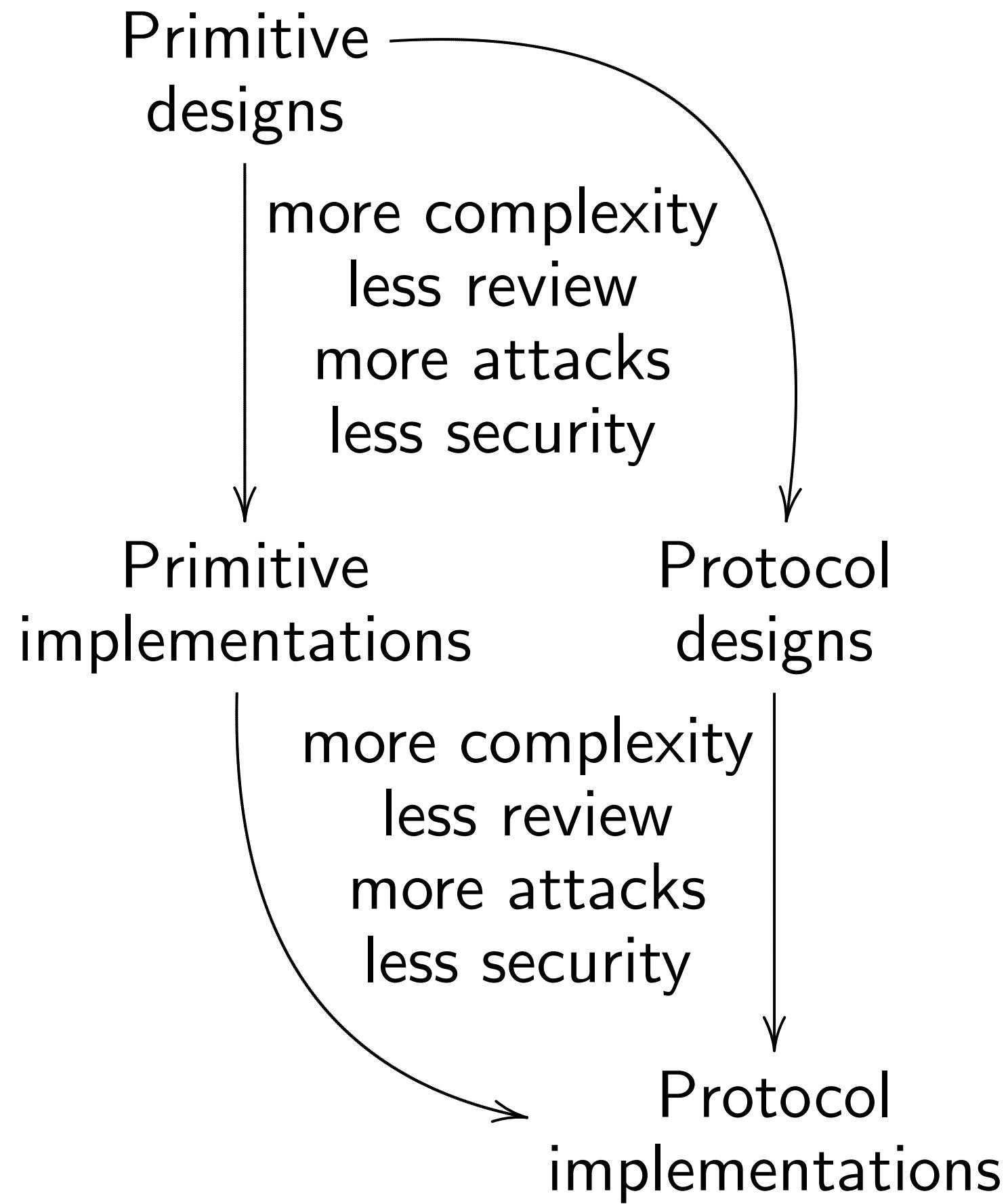
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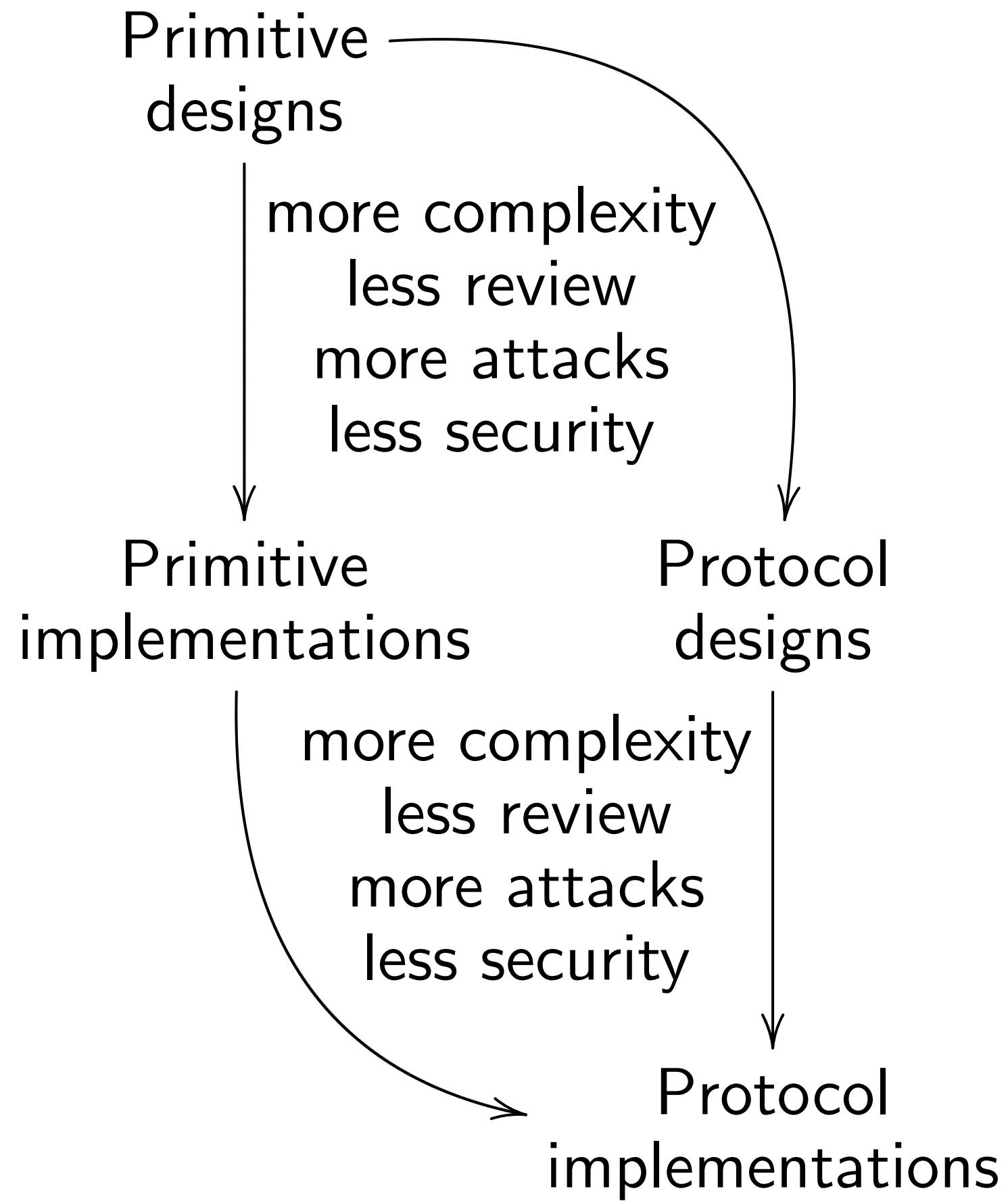


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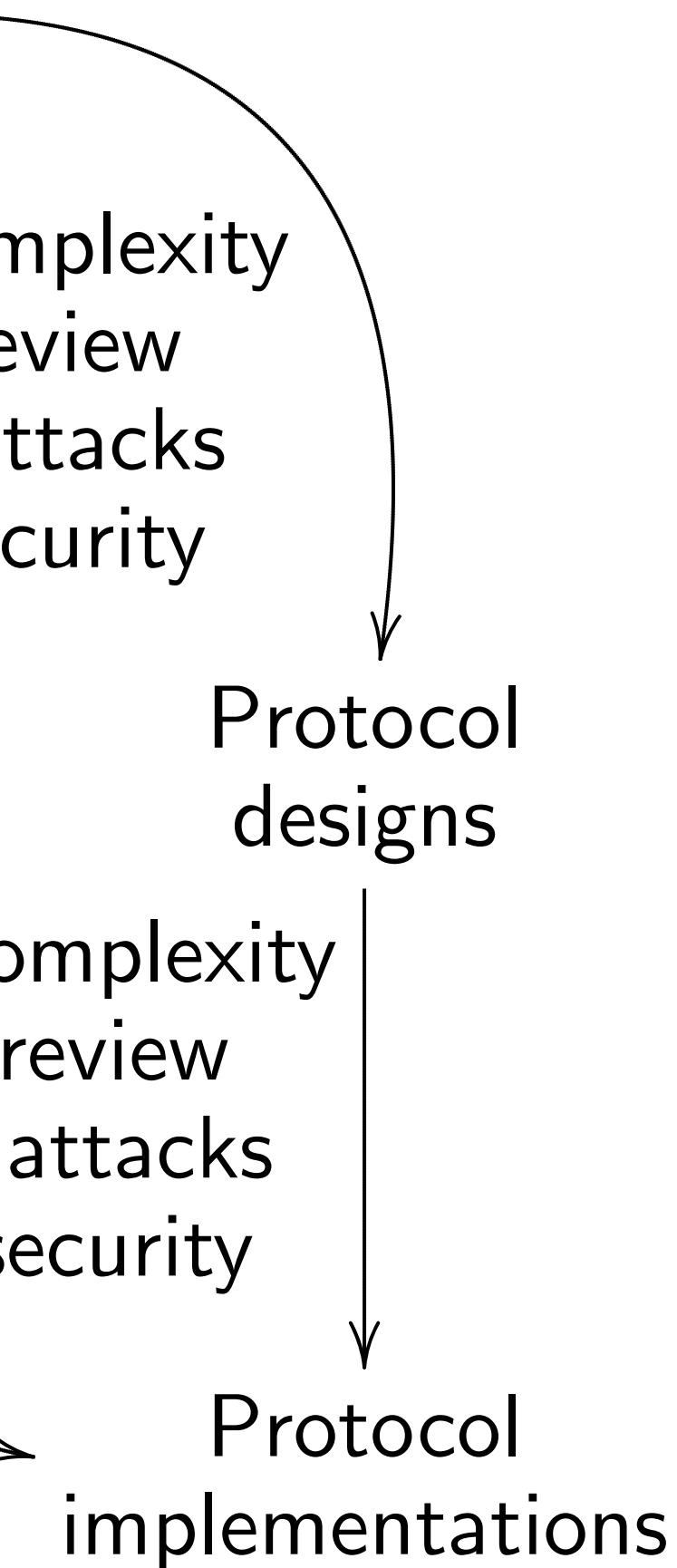
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What about security?

The fundamental goal of “provable security” is to prove that the implementation is as secure as the design, i.e.: Prove that the implementation is as secure as the design. Then it's safe for us to focus on the practicalities.

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The fundamental goal of “provable security”: Prove that the whole system is as secure as the primitive.

i.e.: Prove that the protocol is as secure as the primitive.

Prove that the implementation is as secure as the design.

Then it's safe for reviewers to focus on the primitive design.

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Problem 2: Most proofs are of
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What about security proofs?

The fundamental goal
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Prove that the whole system
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i.e.: Prove that the protocol
is as secure as the primitive.

Prove that the implementation
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Then it's safe for reviewers
to focus on the primitive design.

Maybe will succeed someday, but
needs to overcome huge problems.

Problem 1: “Proofs” have errors.
Proofs are increasingly complex,
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Problem 2: Most proofs are of
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