zkFOCIL

George, Thomas, Benedikt

Talk By Benedikt

Ethereum Foundation Cryptography Research

Recap: FOCIL

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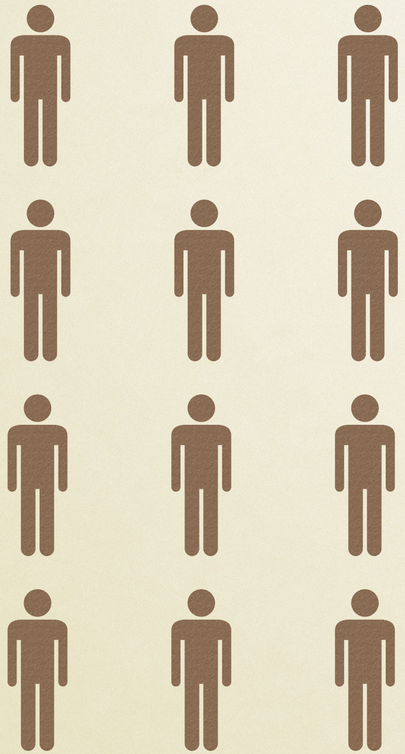
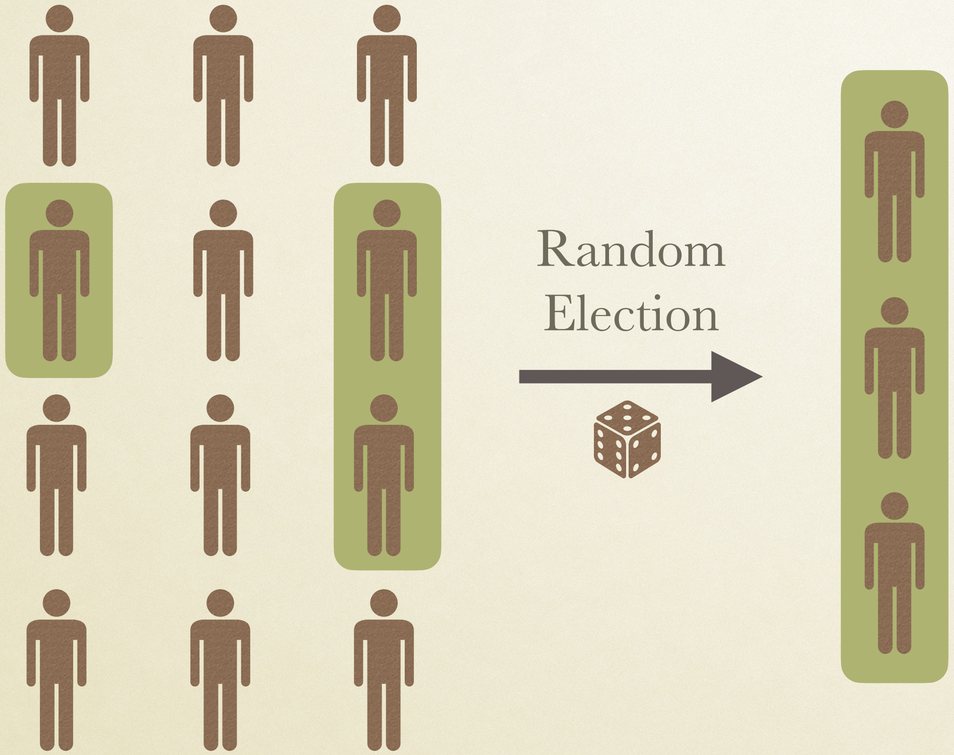


Validators

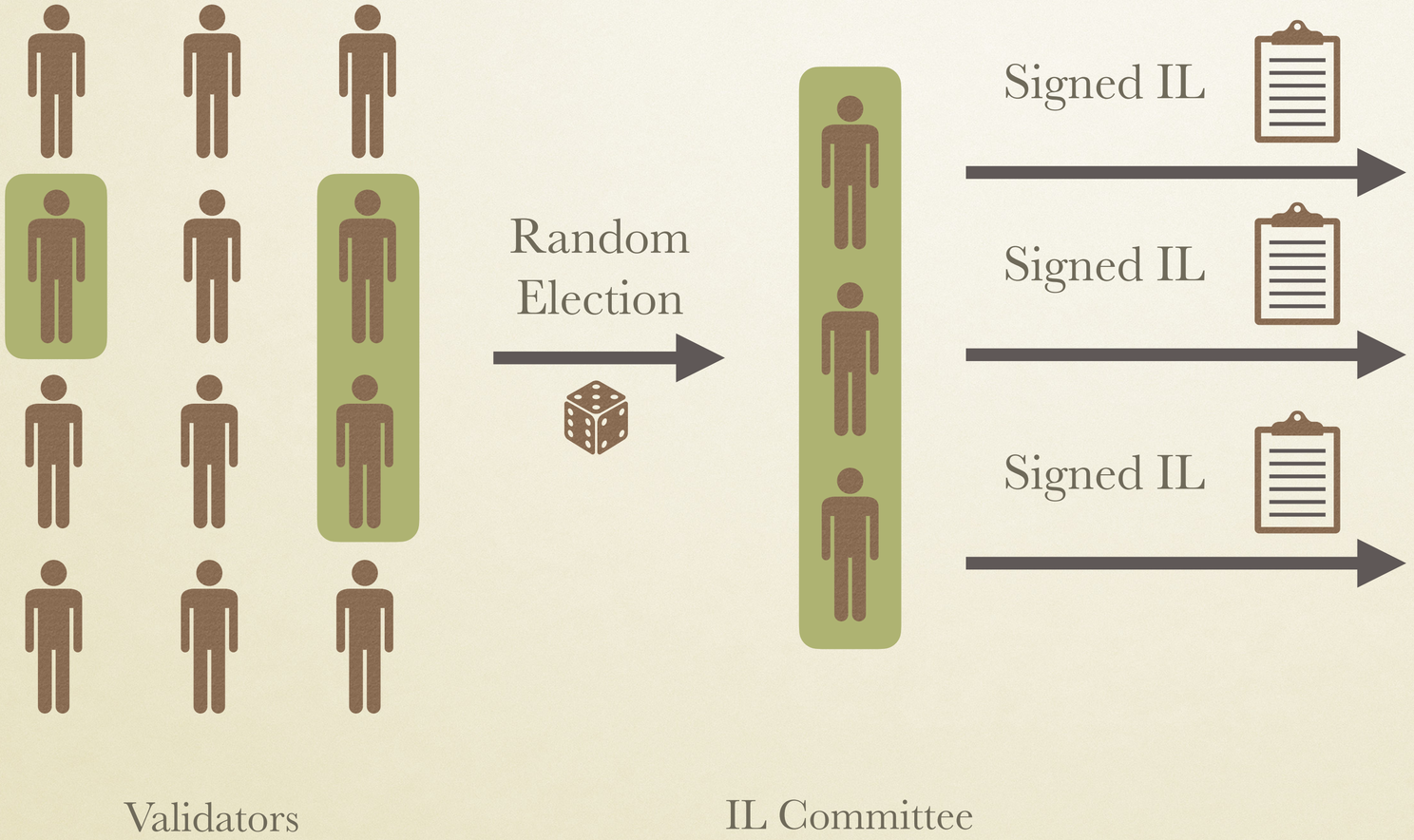
Recap: FOCIL



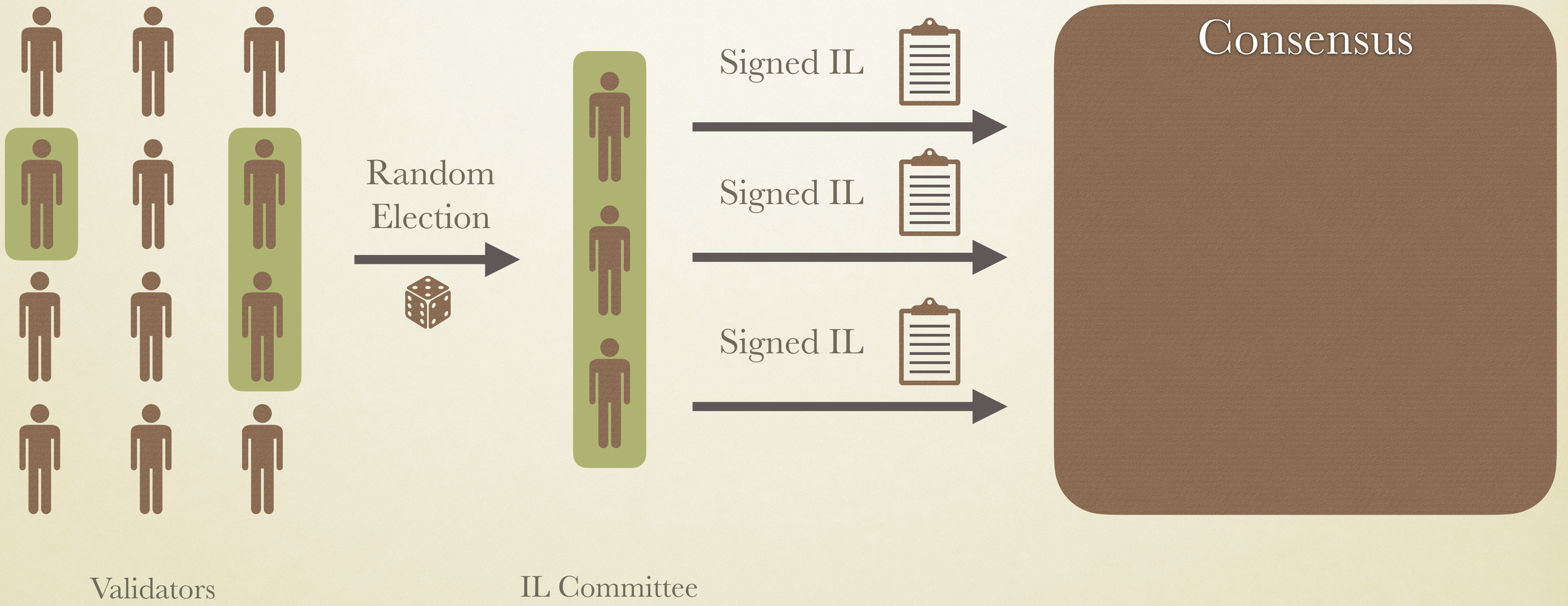
Validators

IL Committee

Recap: FOCIL


Random
Election
Signed IL
Signed IL
Signed IL
Validators
IL Committee

Recap: FOCIL


Random
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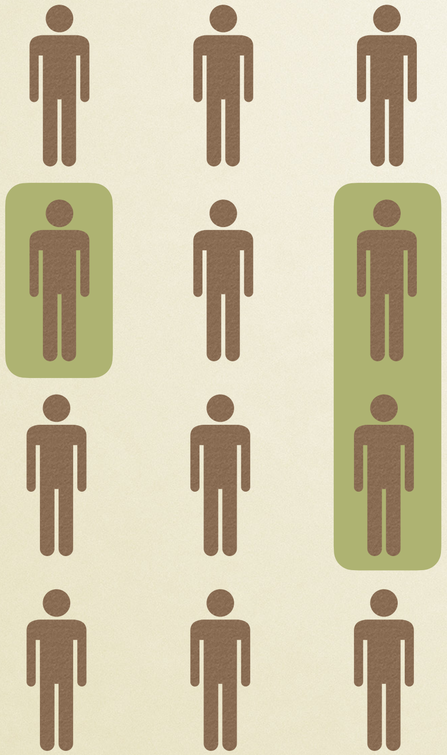
Recap: FOCIL



Validators

Random Election

IL Committee

Signed IL

Signed IL

Signed IL

Consensus

IF

Signed by committee member

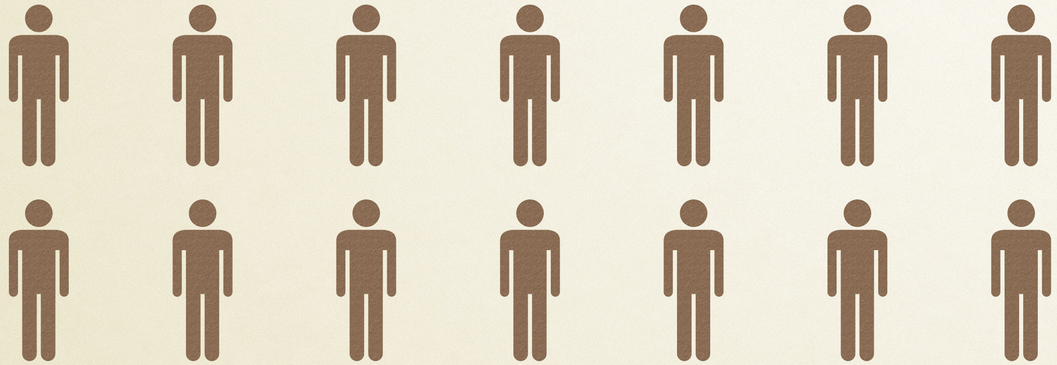
THEN

Force inclusion

Recap: FOCIL

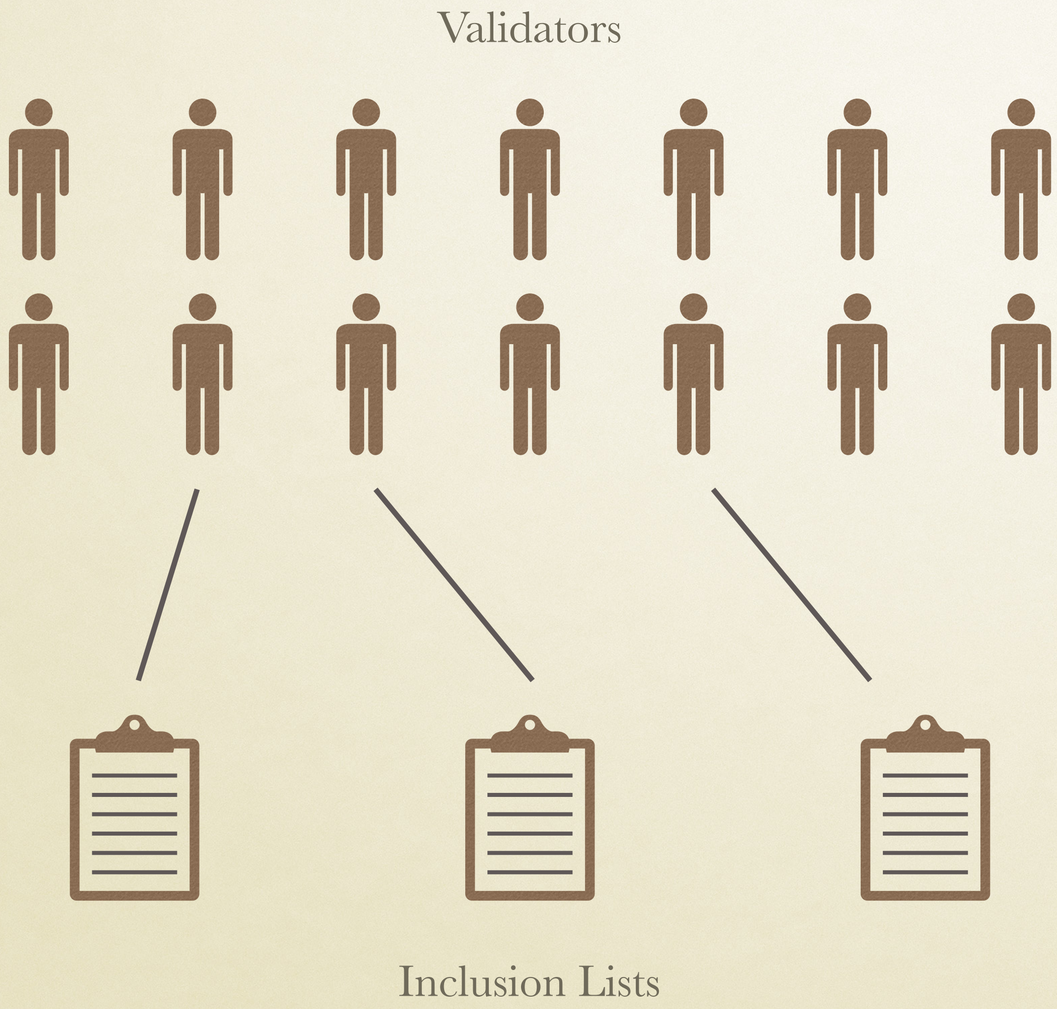
Recap: FOCIL

Validators

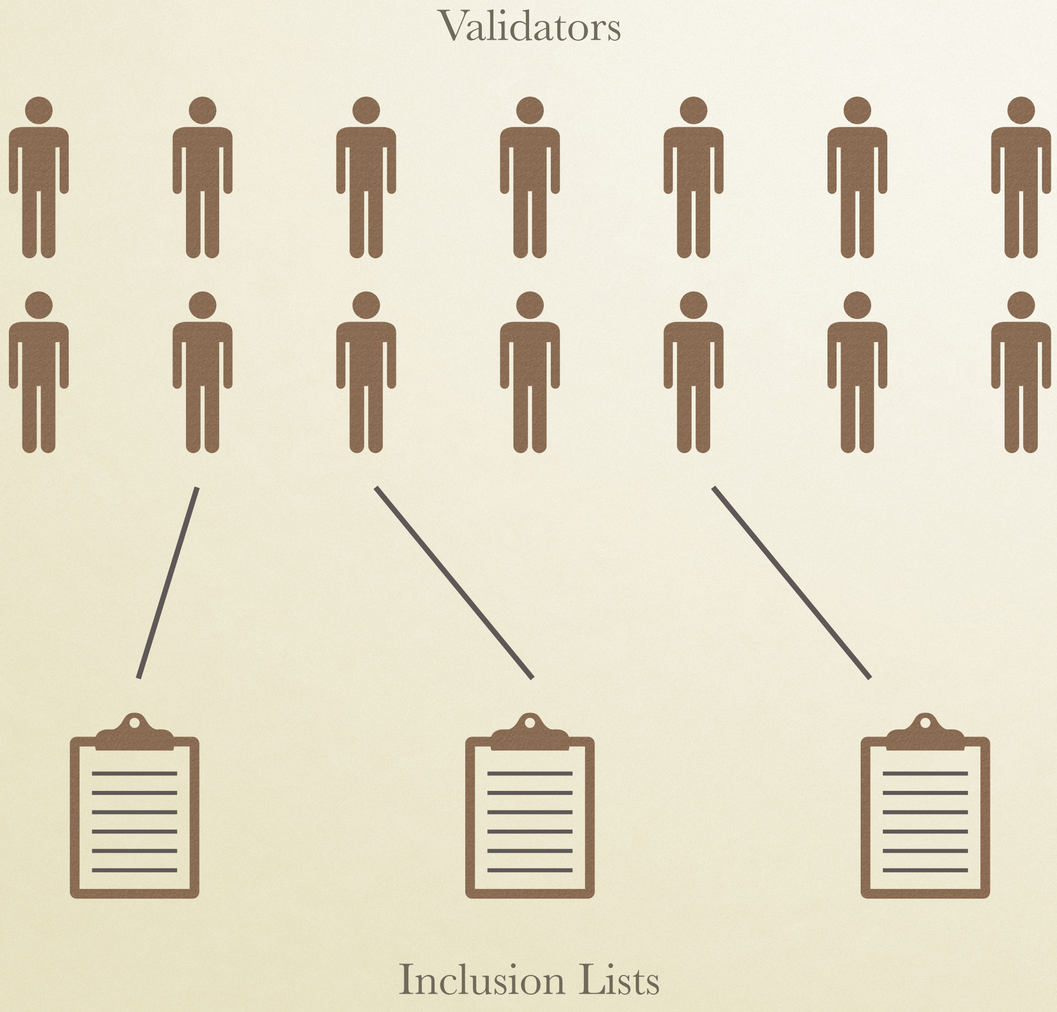


Inclusion Lists

Recap: FOCIL



Recap: FOCIL



Can we hide the link?

Goals of zkFOCIL

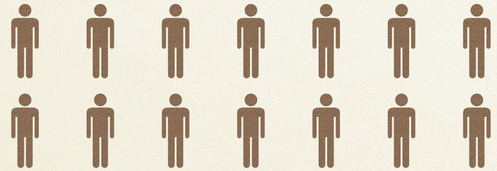
Goals of zkFOCIL

Security

Goals of zkFOCIL

Security

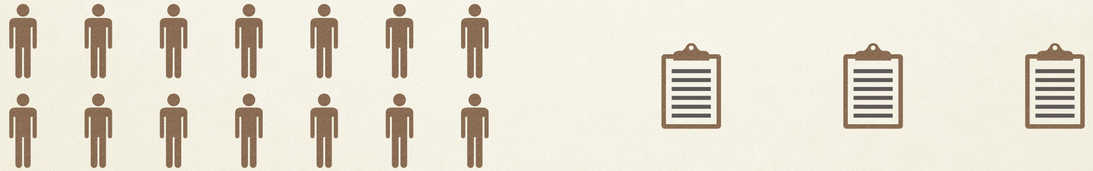
ILs Unlinkable + Hidden Committee



Goals of zkFOCIL

Security

ILs Unlinkable + Hidden Committee

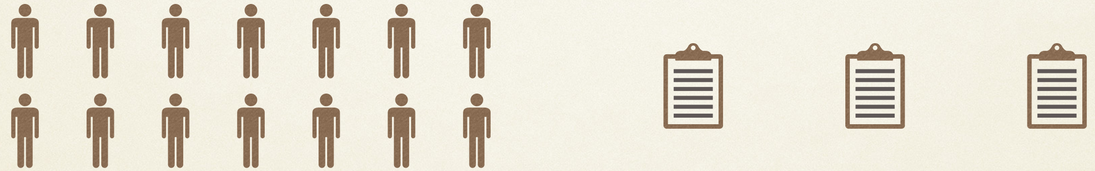


Unbiased Committee Election

Goals of zkFOCIL

Security

ILs Unlinkable + Hidden Committee



Unbiased Committee Election

Applicability

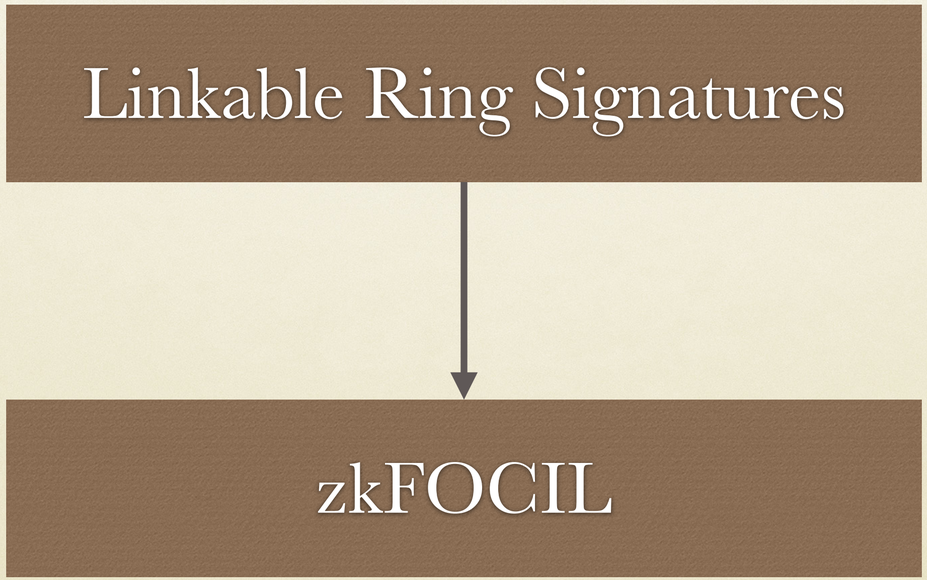
Efficiency Conceptual Simplicity Minimal Protocol Changes

Towards a Construction

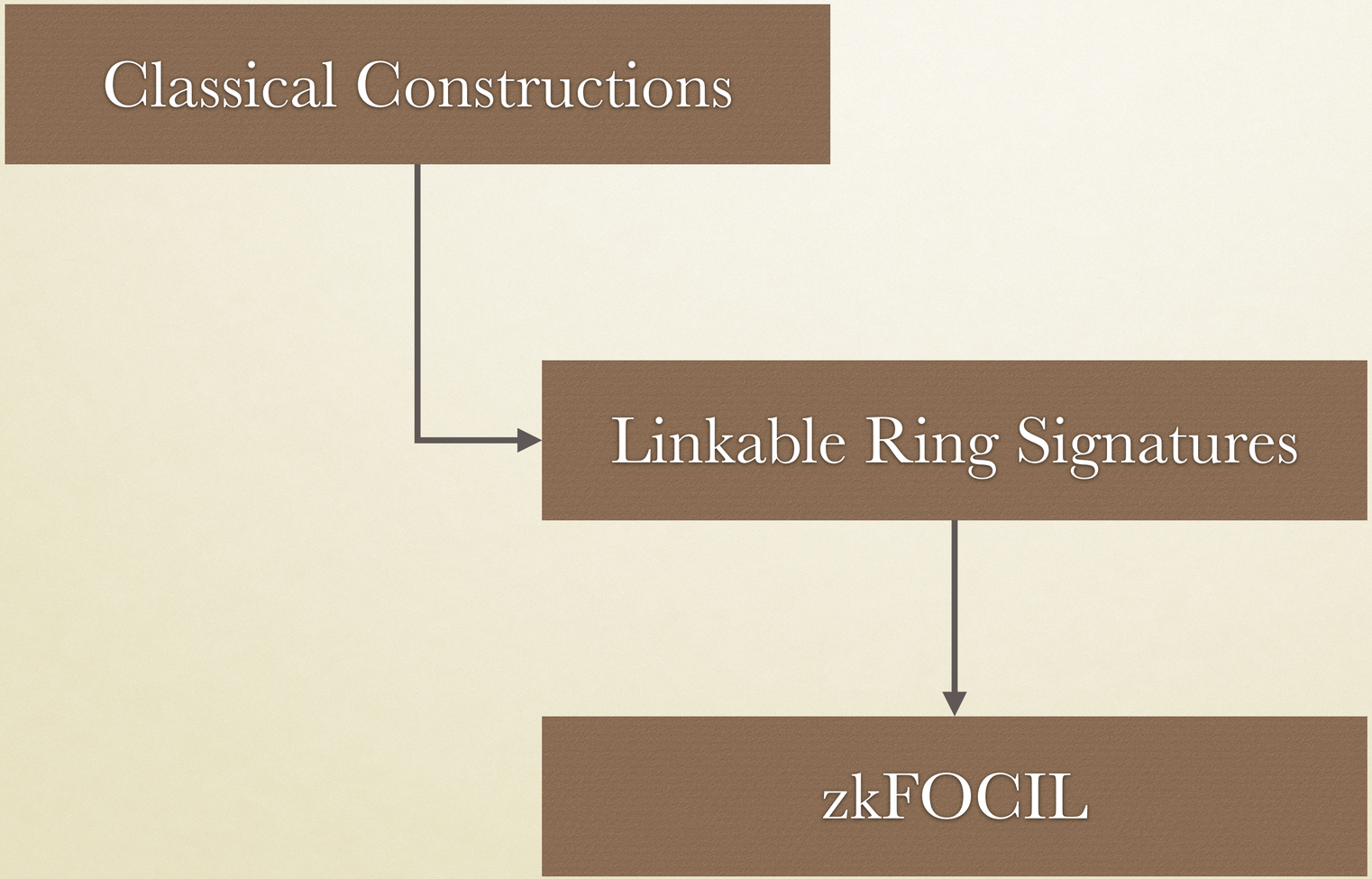
Towards a Construction

zkFOCIL

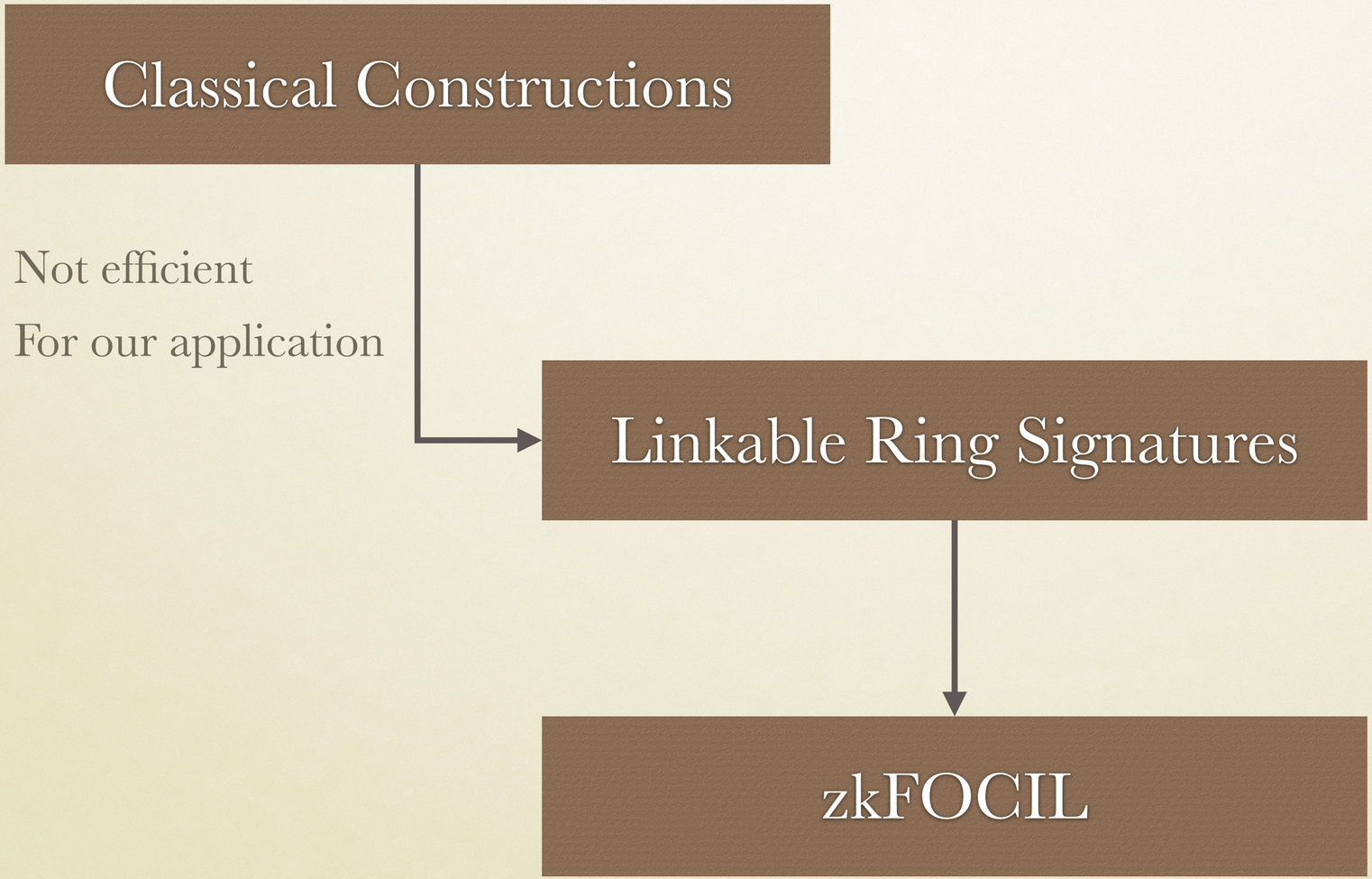
Towards a Construction



Towards a Construction



Towards a Construction



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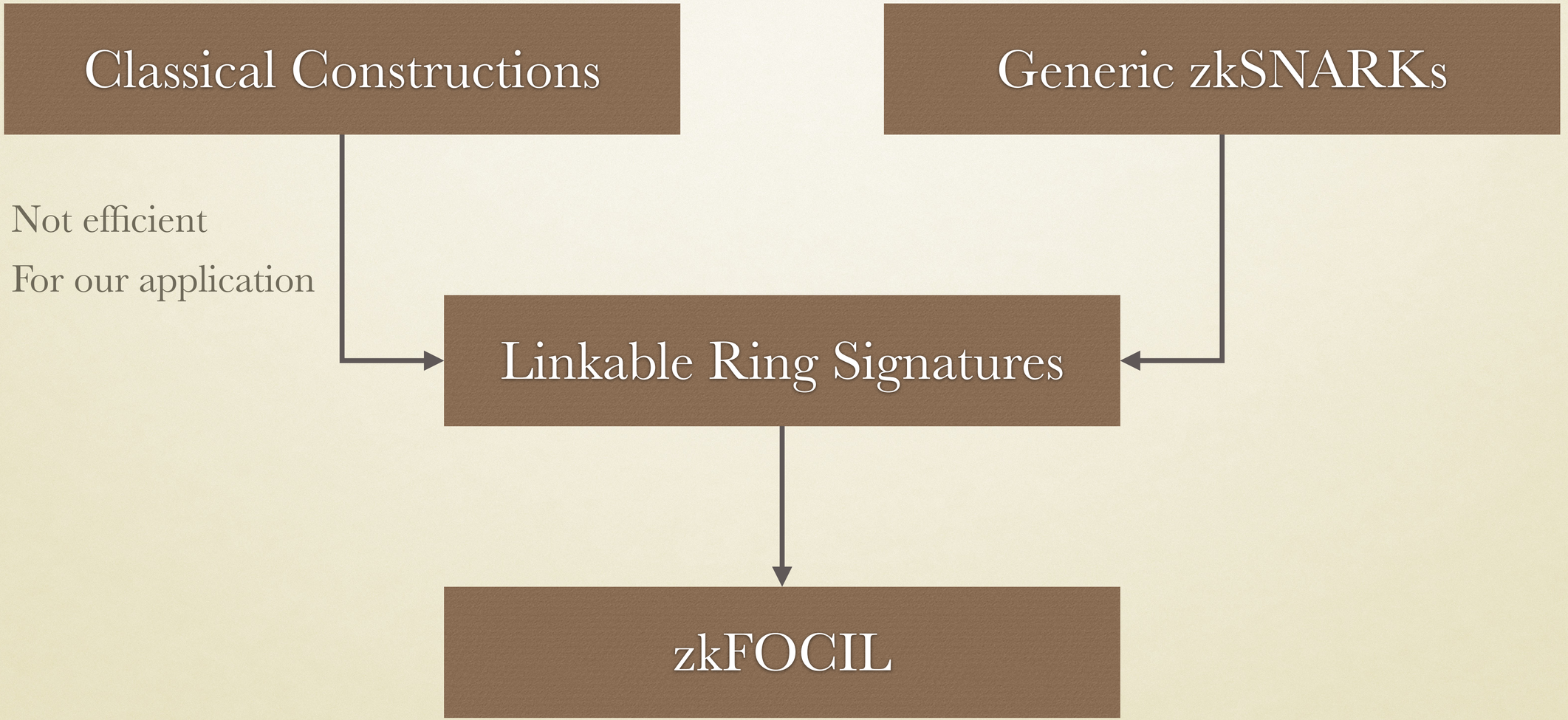
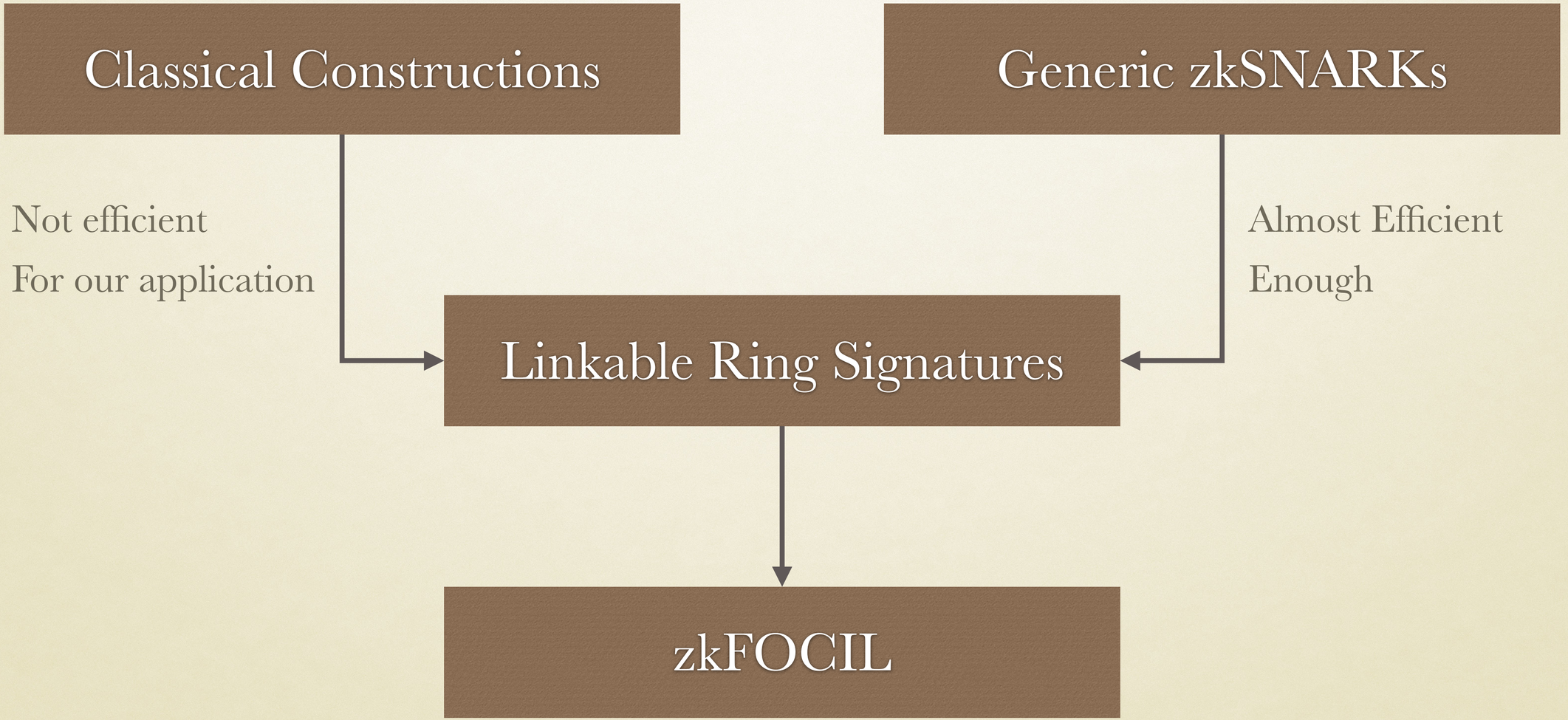
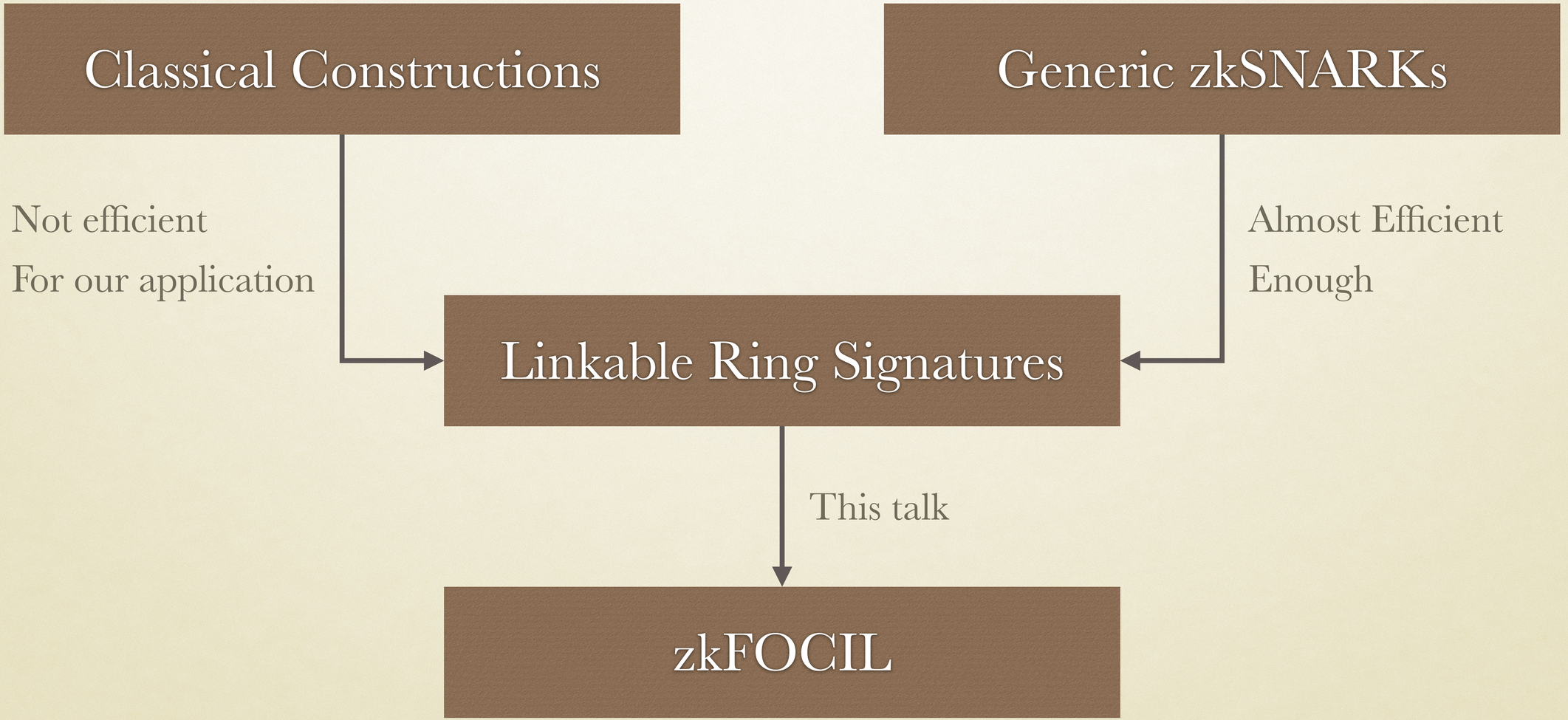


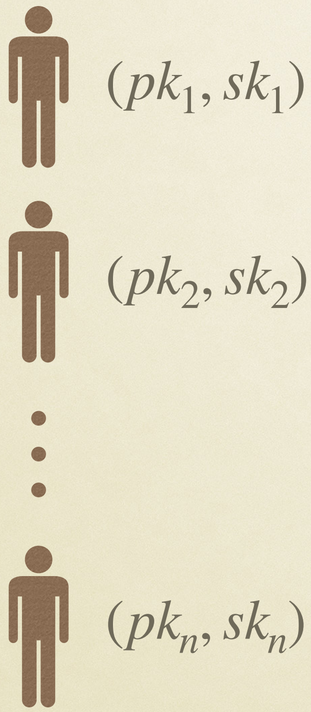
Towards a Construction



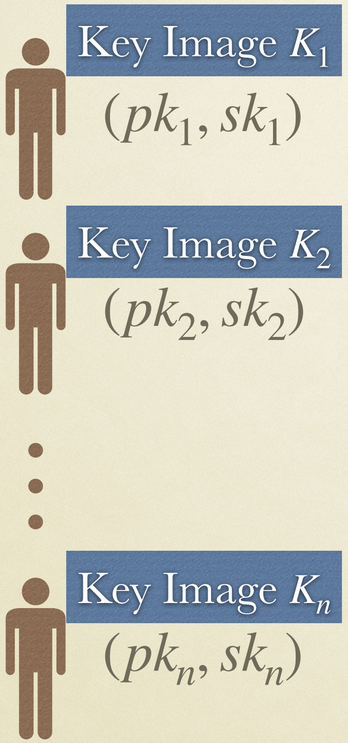
Towards a Construction



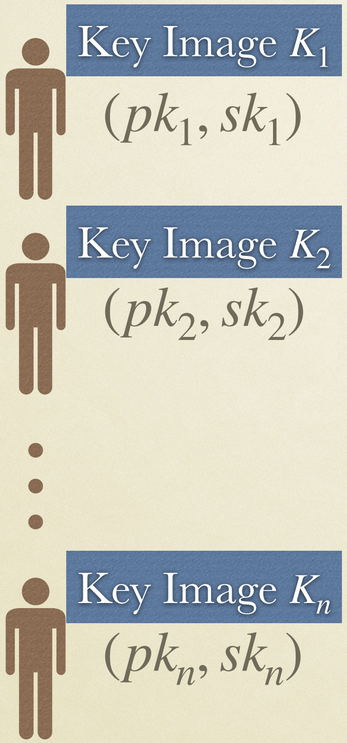
Linkable Ring Signatures



Linkable Ring Signatures

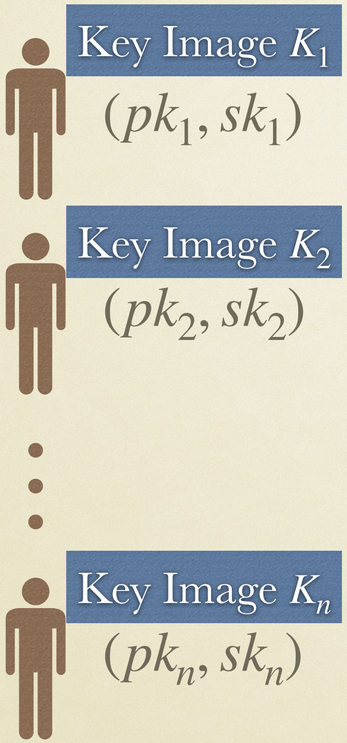


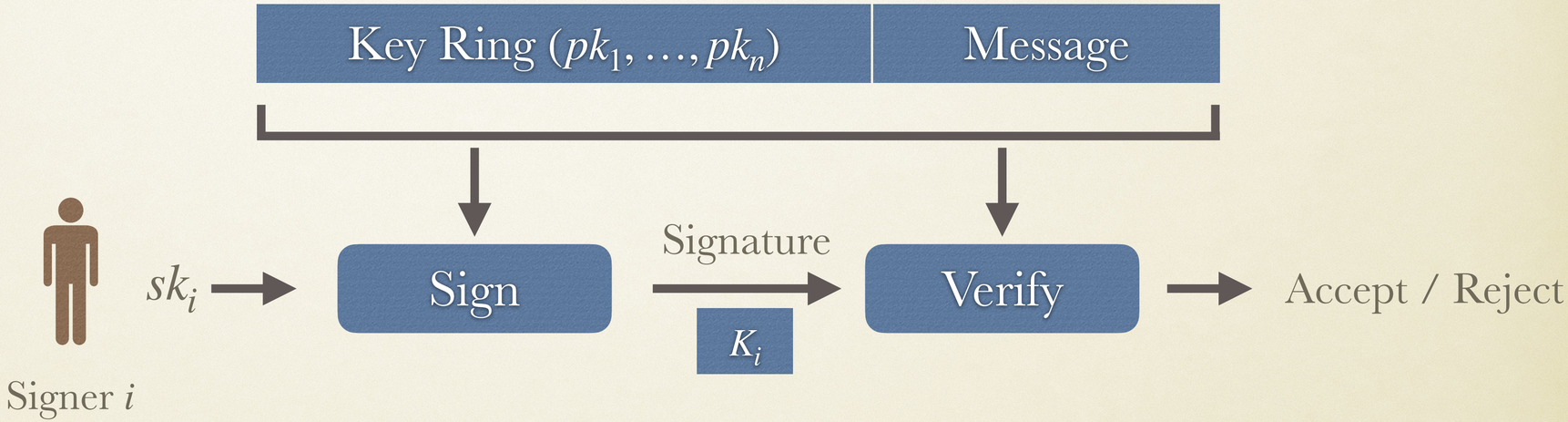
Linkable Ring Signatures



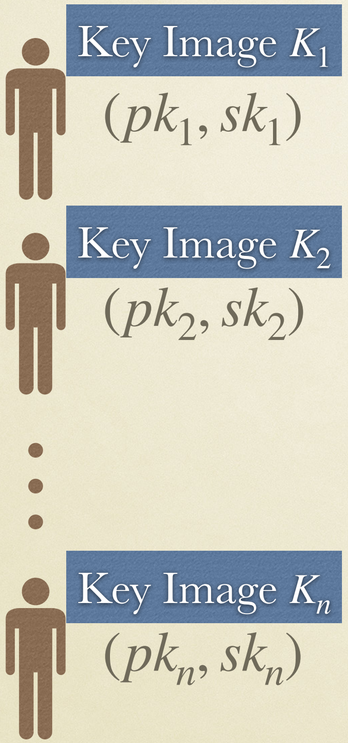
Signer i

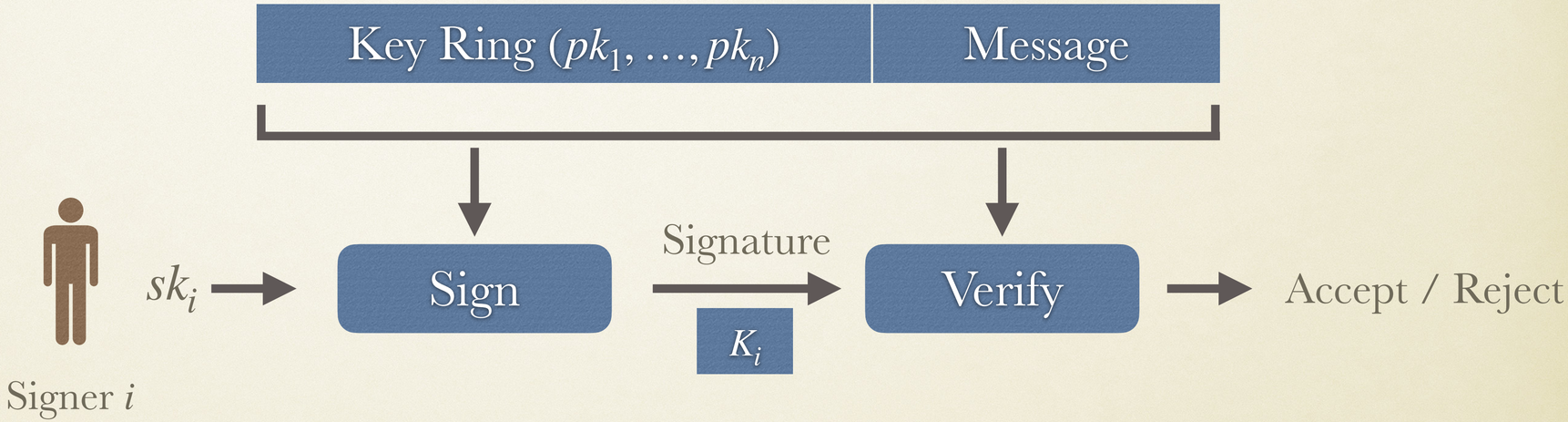
Linkable Ring Signatures





Linkable Ring Signatures





Security

Can only sign using one of the sk_i

(Signature, K_i) does not reveal i

K_i is *unique* pseudonym of pk_i

Linkable Ring Signatures in FOCIL

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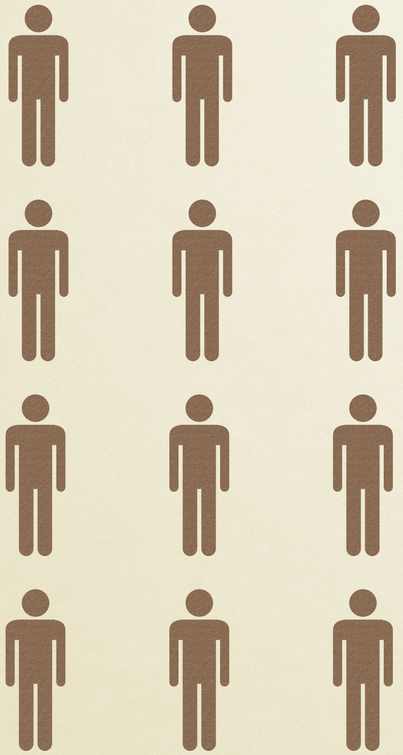

Validators

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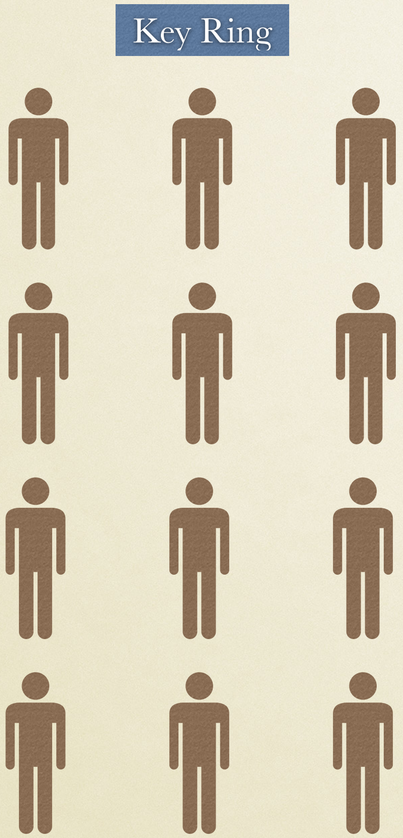

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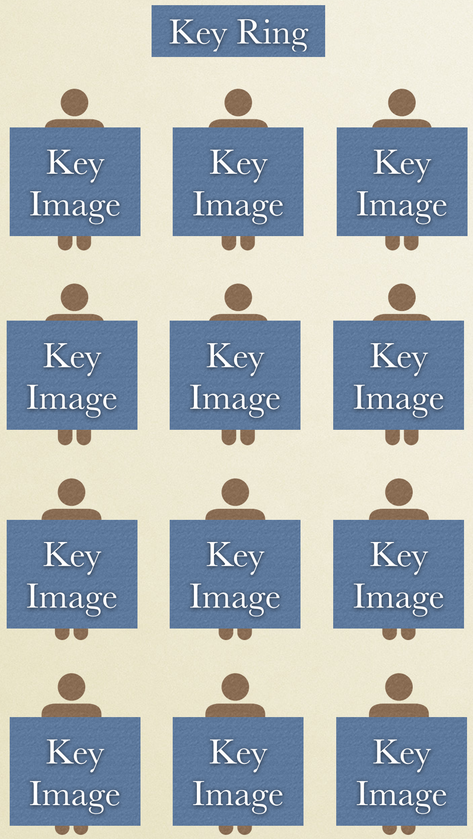

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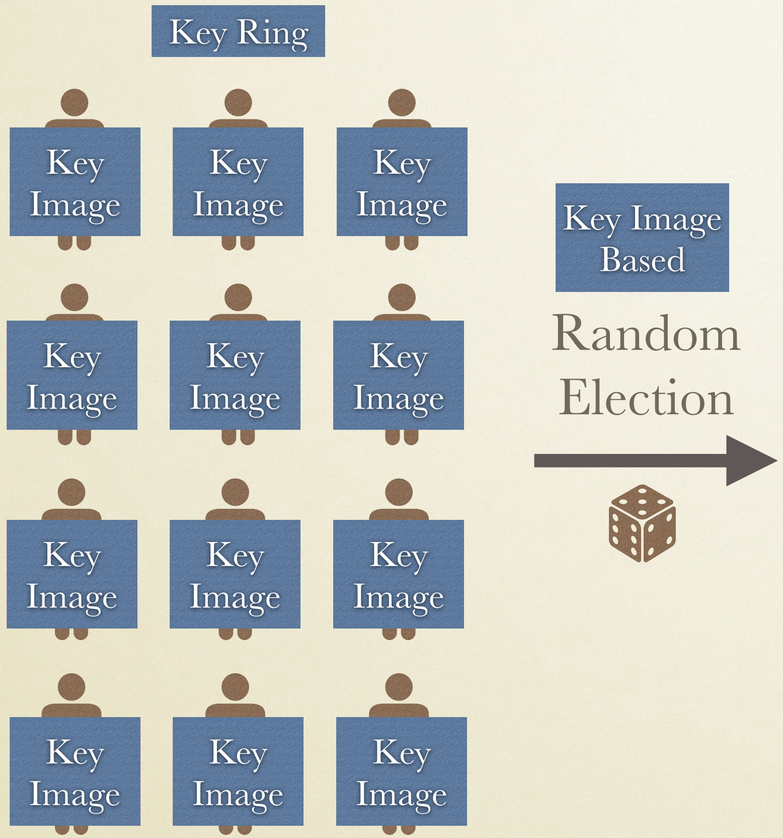

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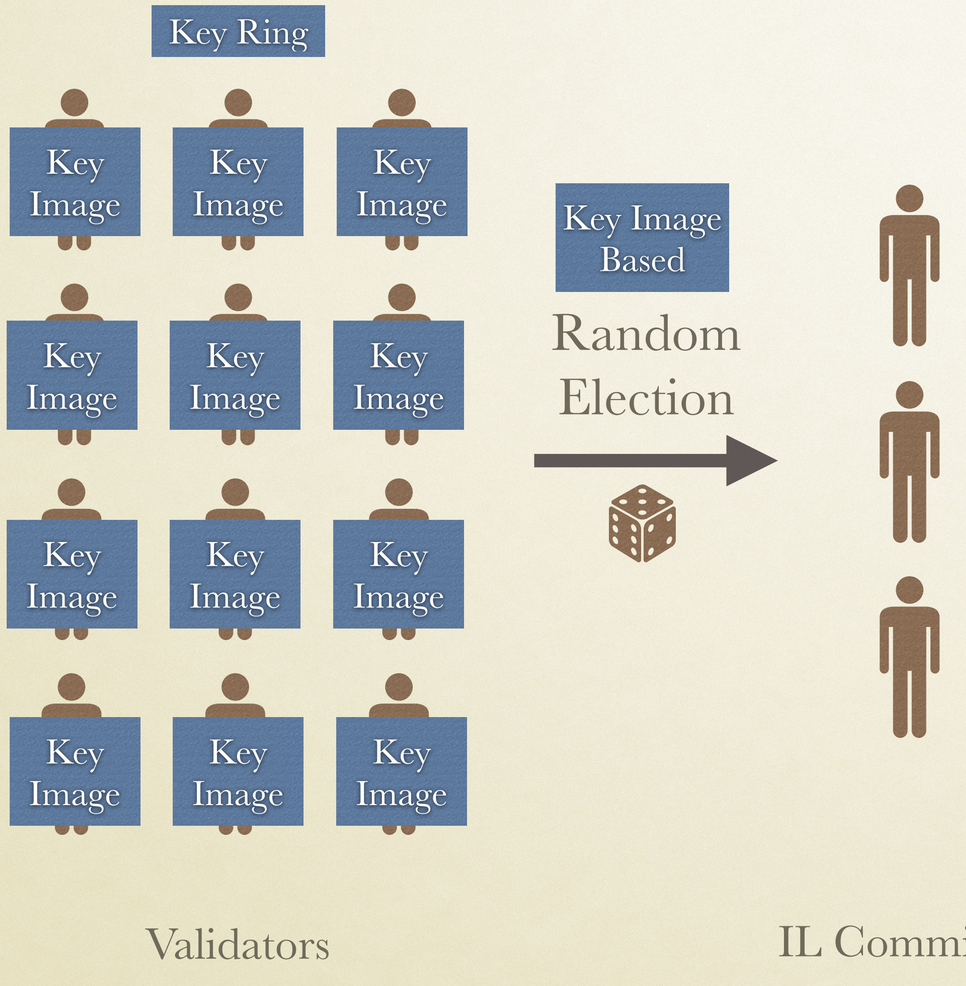

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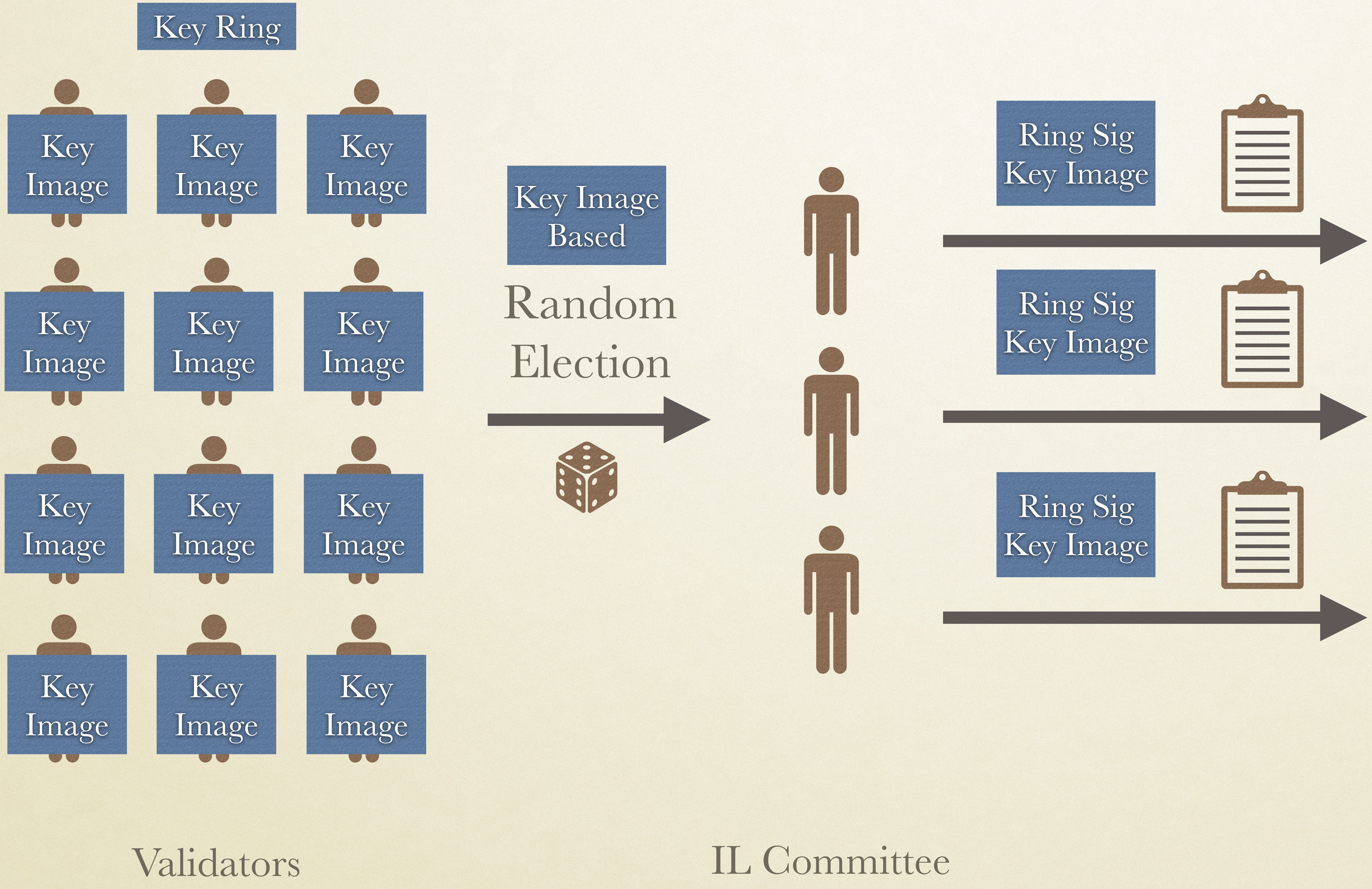

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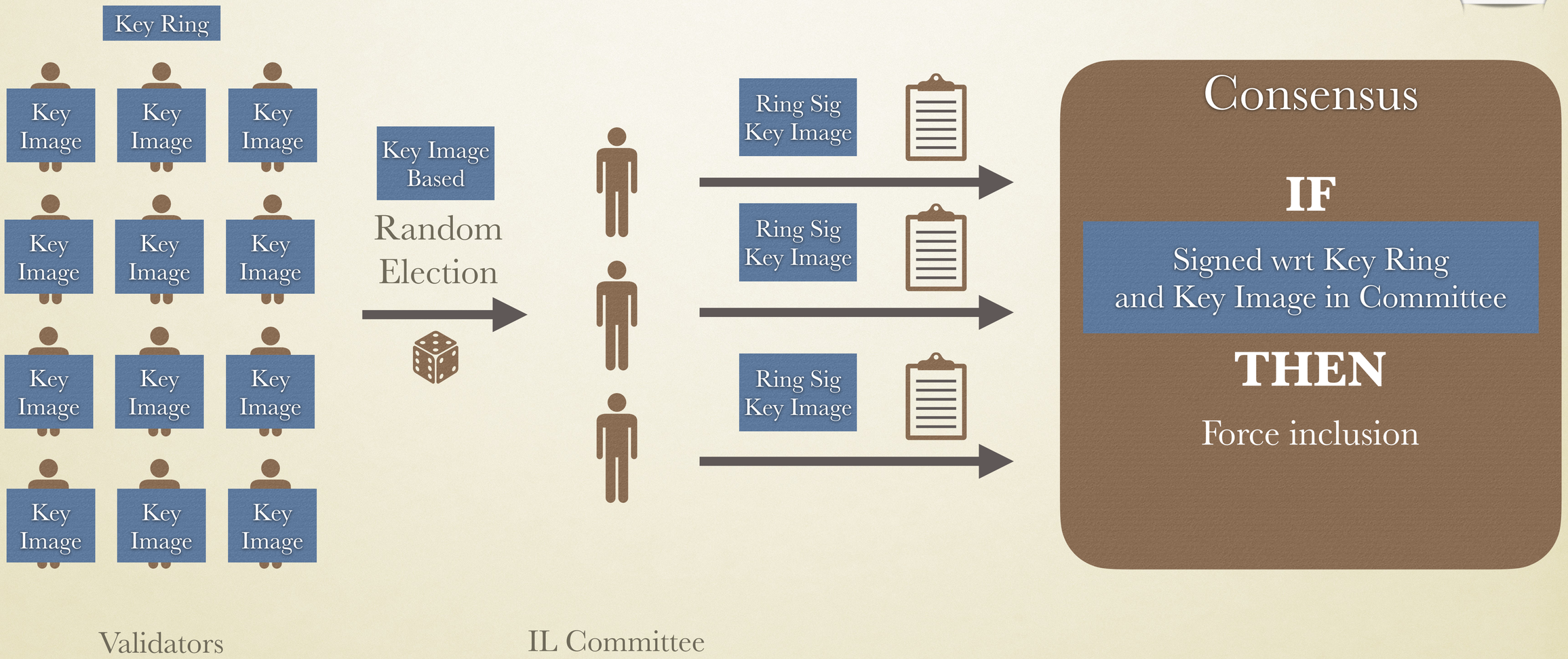

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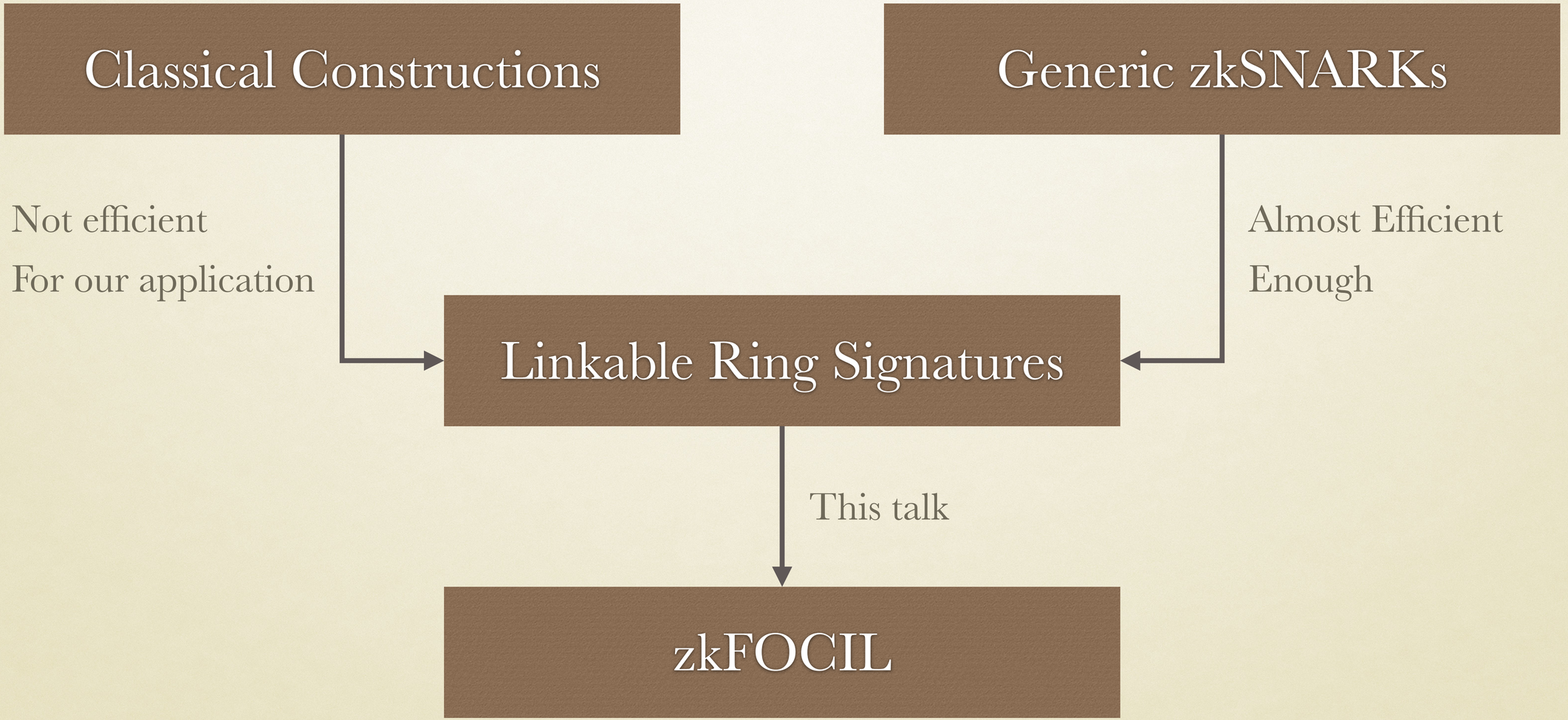
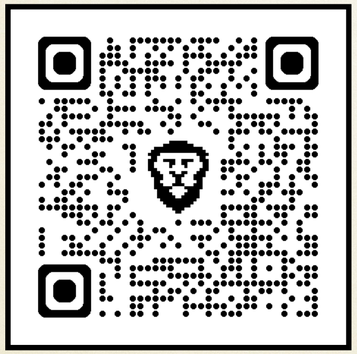


Efficiency (from generic zksnarks)



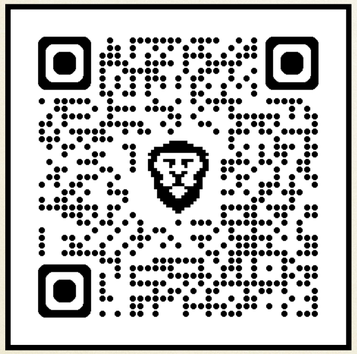
Prototype Implementation

by Shreyas Londhe & Suyash Bagad

* Sig + Key image size ~ 500 Byte

* BN254+IPA / SECP256k1+IPA

Efficiency (from generic zksnarks)



Prototype Implementation

by Shreyas Londhe & Suyash Bagad

Key Image + Proof	< 2.5 s
Sign IL	~ BLS sig
Verify Sig + Key Image	87 ms

* Sig + Key image size ~ 500 Byte

* BN254+IPA / SECP256k1+IPA

Next Steps

Next Steps

More efficient Construction

Next Steps

More efficient Construction

zkFOCIL Combinatorics

Next Steps

More efficient Construction

zkFOCIL Combinatorics

Integration into FOCIL

Thank You