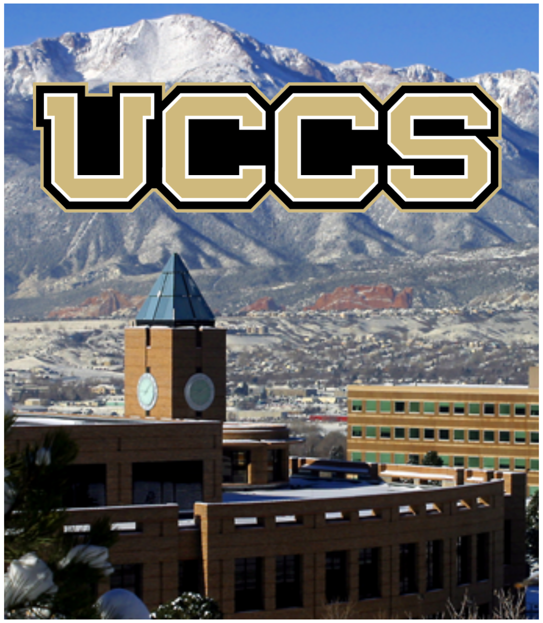


Cryptographic Hash and Integrity Protection

Digital Signature

Sang-Yoon Chang, Ph.D.

Module: Digital Signature

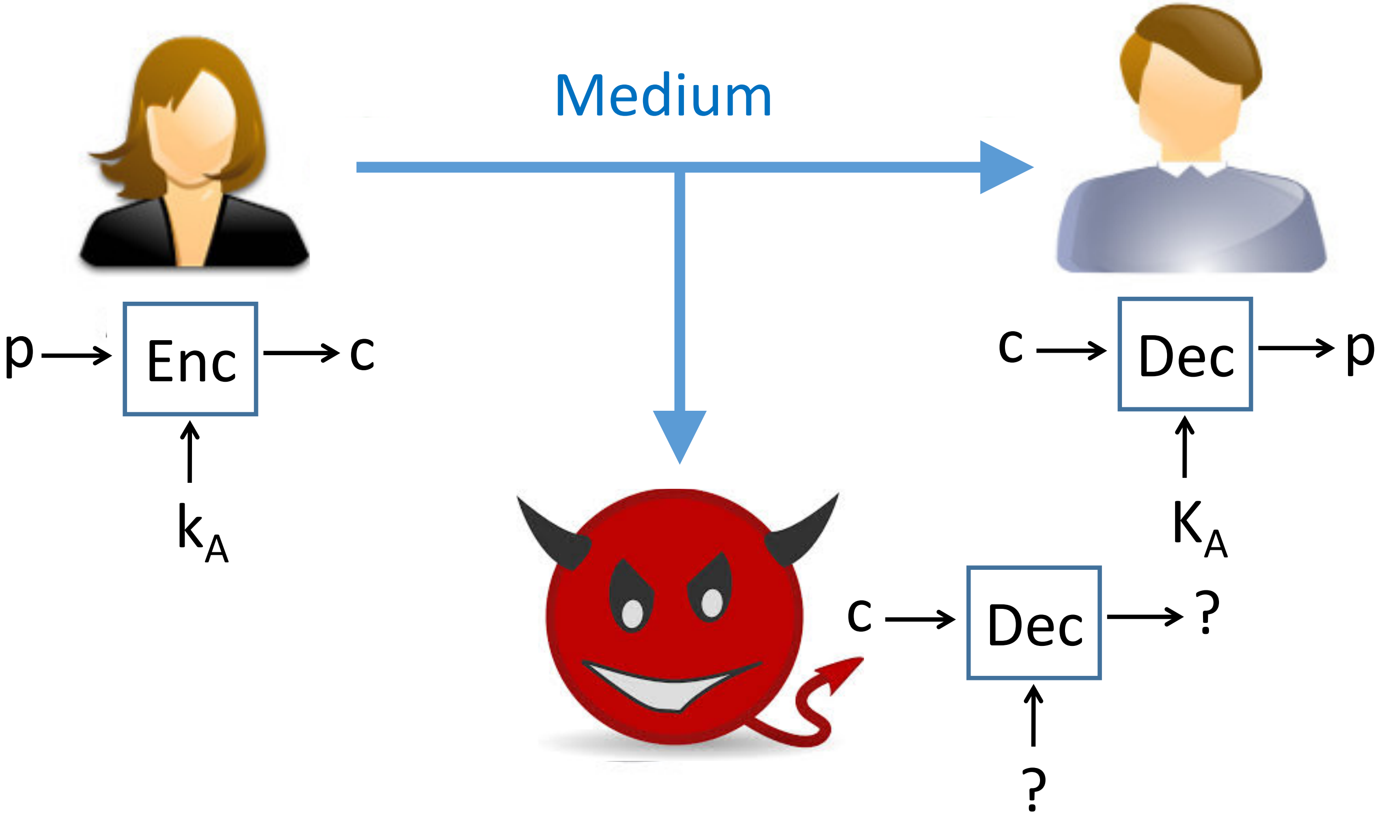
Asymmetric Cryptography and Integrity

Digital Signature Objectives

Digital Signature Requirements

Digital Signature Construction,
e.g., RSA and DSS

Asymmetric: Alice uses Alice’s private key k_A



Medium

p → Enc → c

k_A

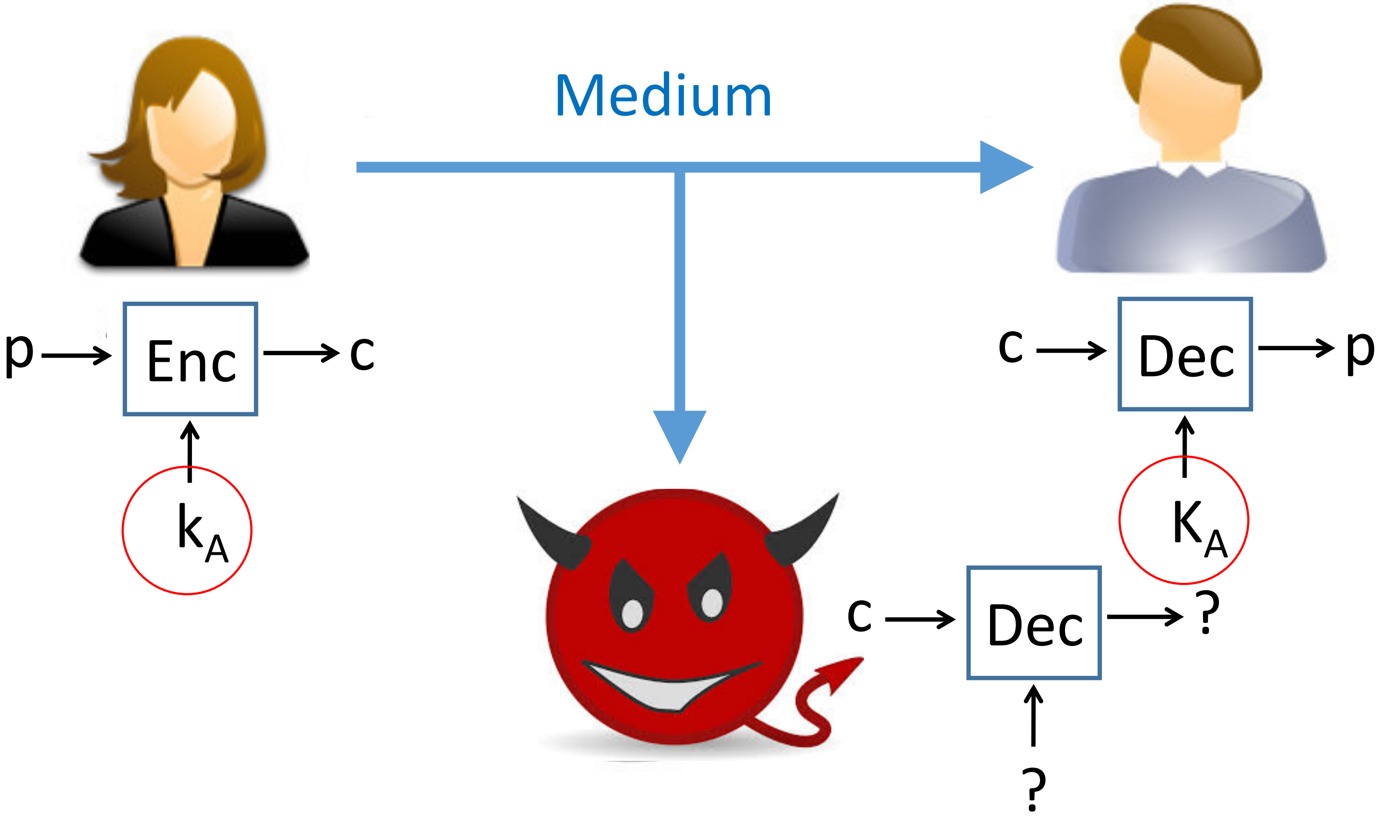
c → Dec → p

K_A

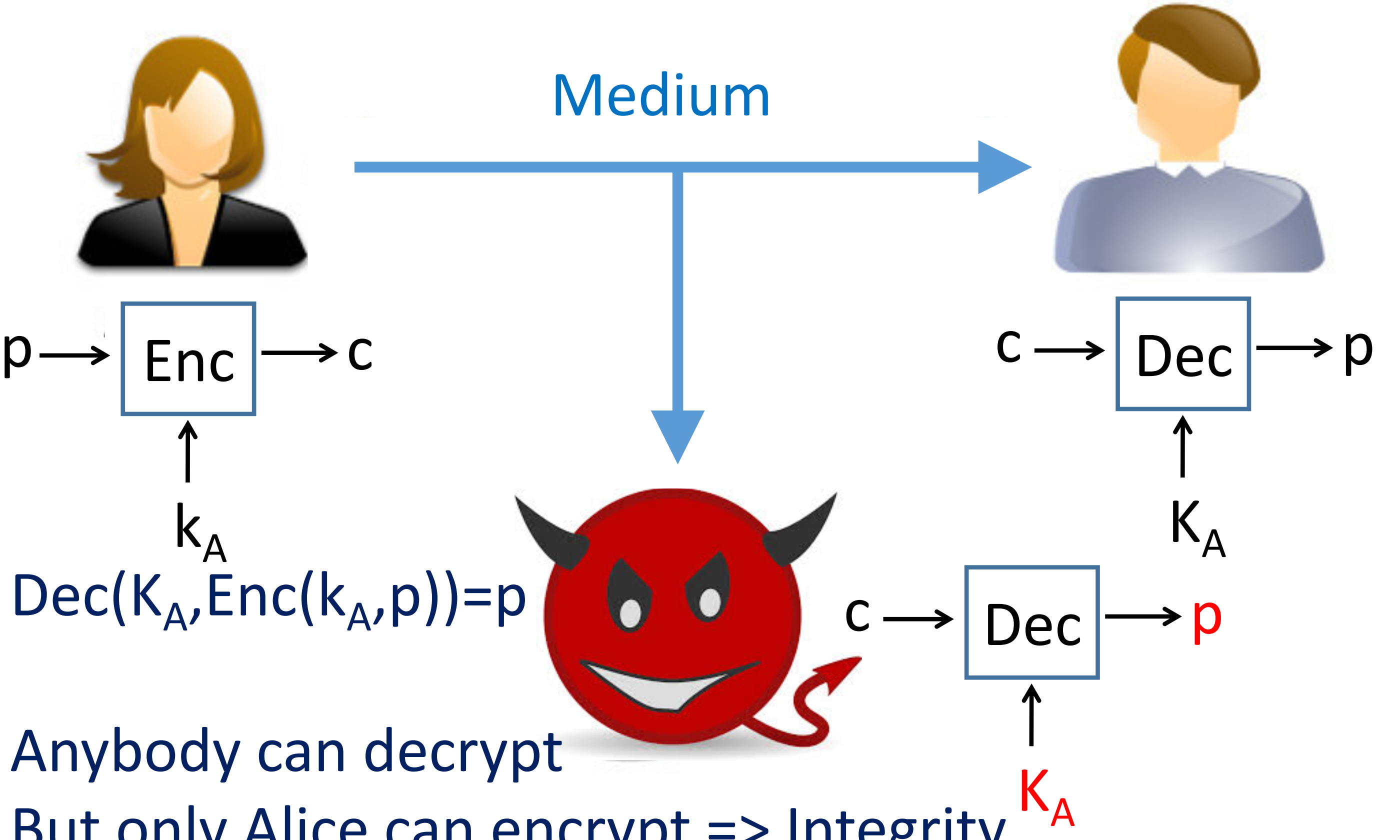
c → Dec → ?

?

Asymmetric: Alice uses Alice's private key k_A



Asymmetric: Alice uses Alice's private key k_A

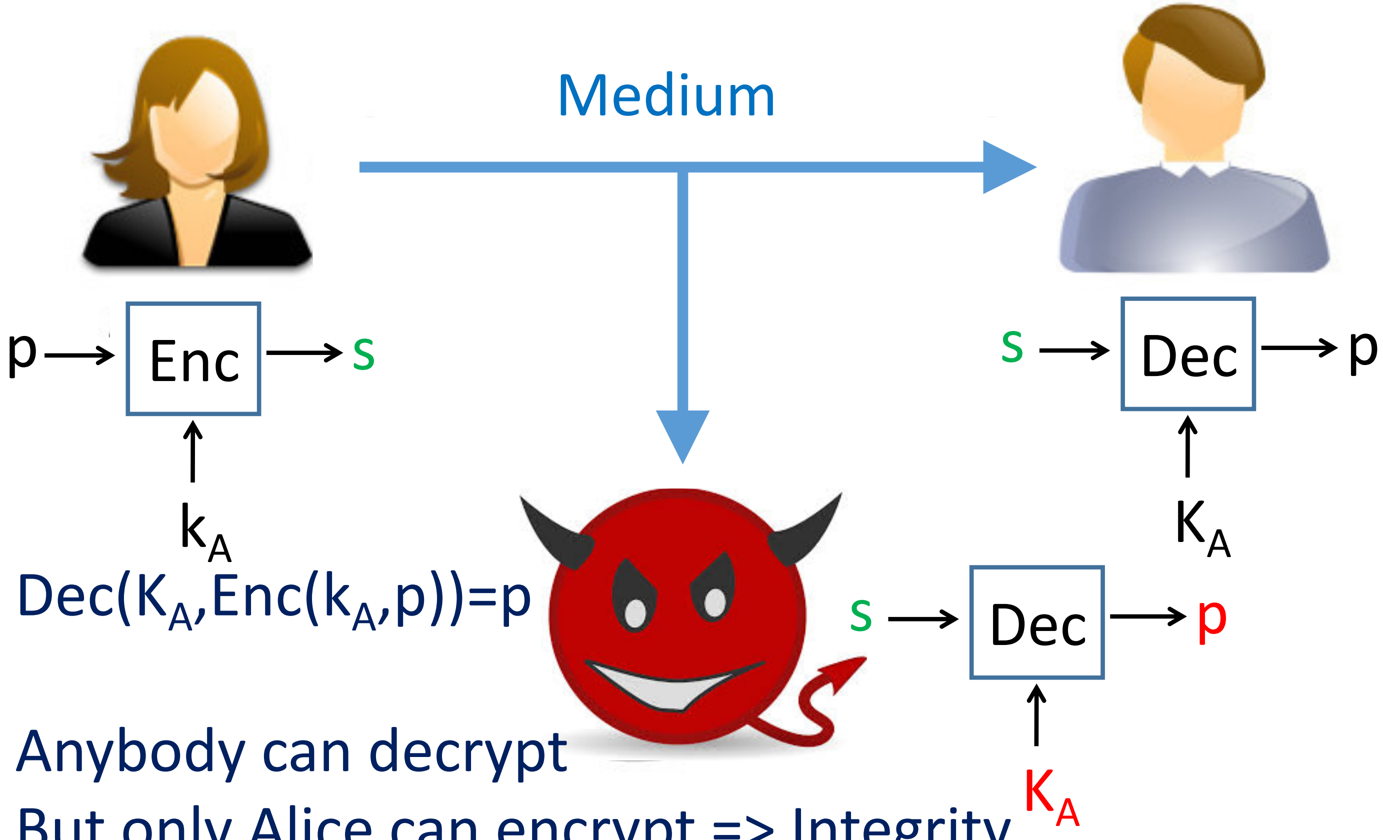


$Dec(K_A,Enc(k_A,p))=p$

Anybody can decrypt

But only Alice can encrypt => Integrity

Asymmetric: Alice uses Alice's private key k_A



Medium

$p \rightarrow$ Enc $\rightarrow s$

k_A

$s \rightarrow$ Dec $\rightarrow p$

K_A

$s \rightarrow$ Dec $\rightarrow p$

K_A

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Message Authentication Recap

Message authentication is to:

- Protect message integrity
- Sender authentication

Prevent threats, including:

- Masquerading/spoofing
- Content modification
- Sequence modification
- Timing modification

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It does not address trust between parities

Digital Signature

Prevent threats:

- Another user spoofs the sender
- Receiver forges a received message
- Sender deny sending message

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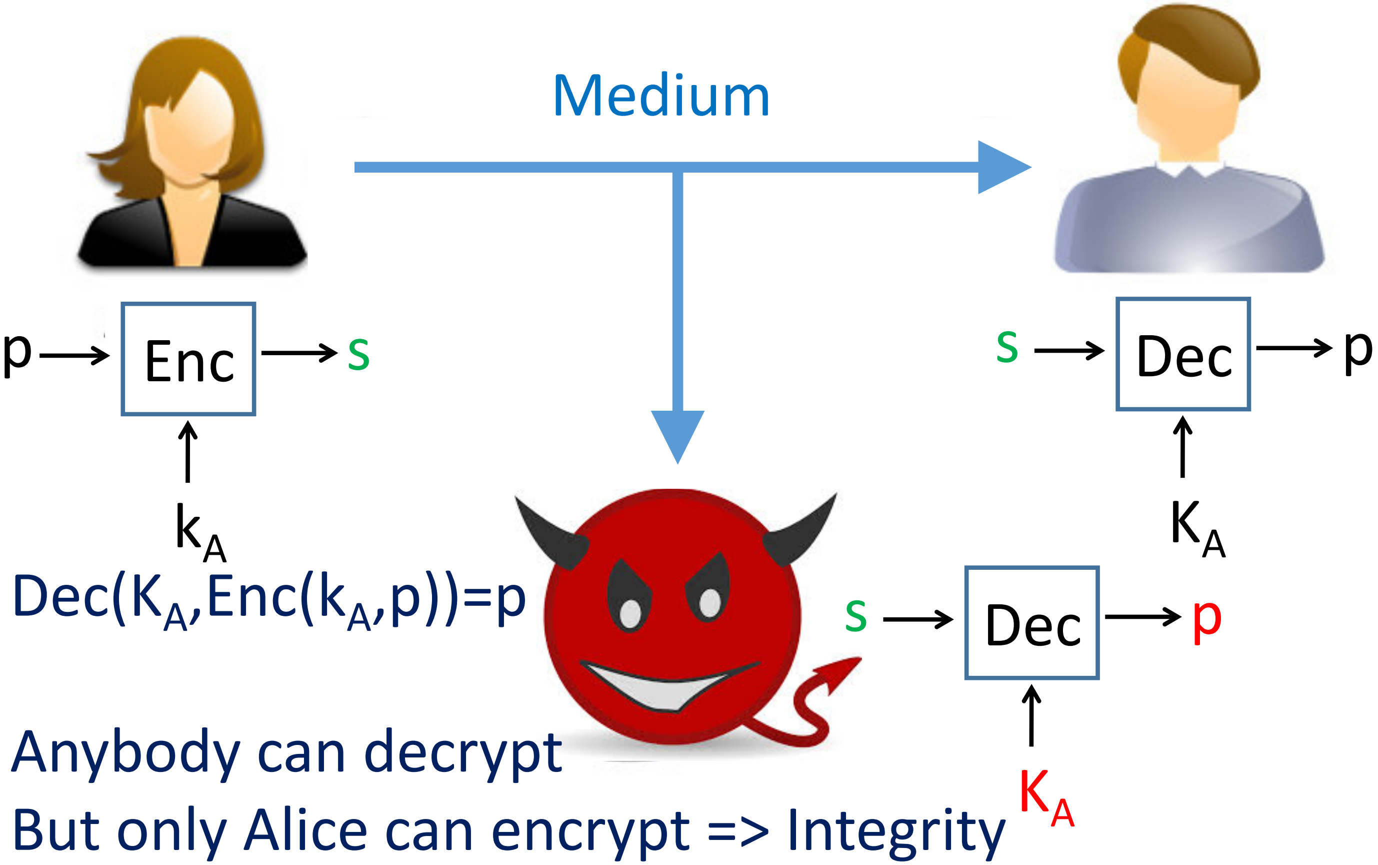
Easy to recognize and verify

Infeasible to forge

Able to retain a copy in storage

Asymmetric: Alice uses Alice's private key k_A



Medium

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K_A

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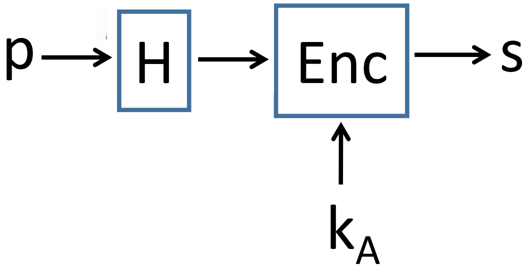
Digital Signature



p

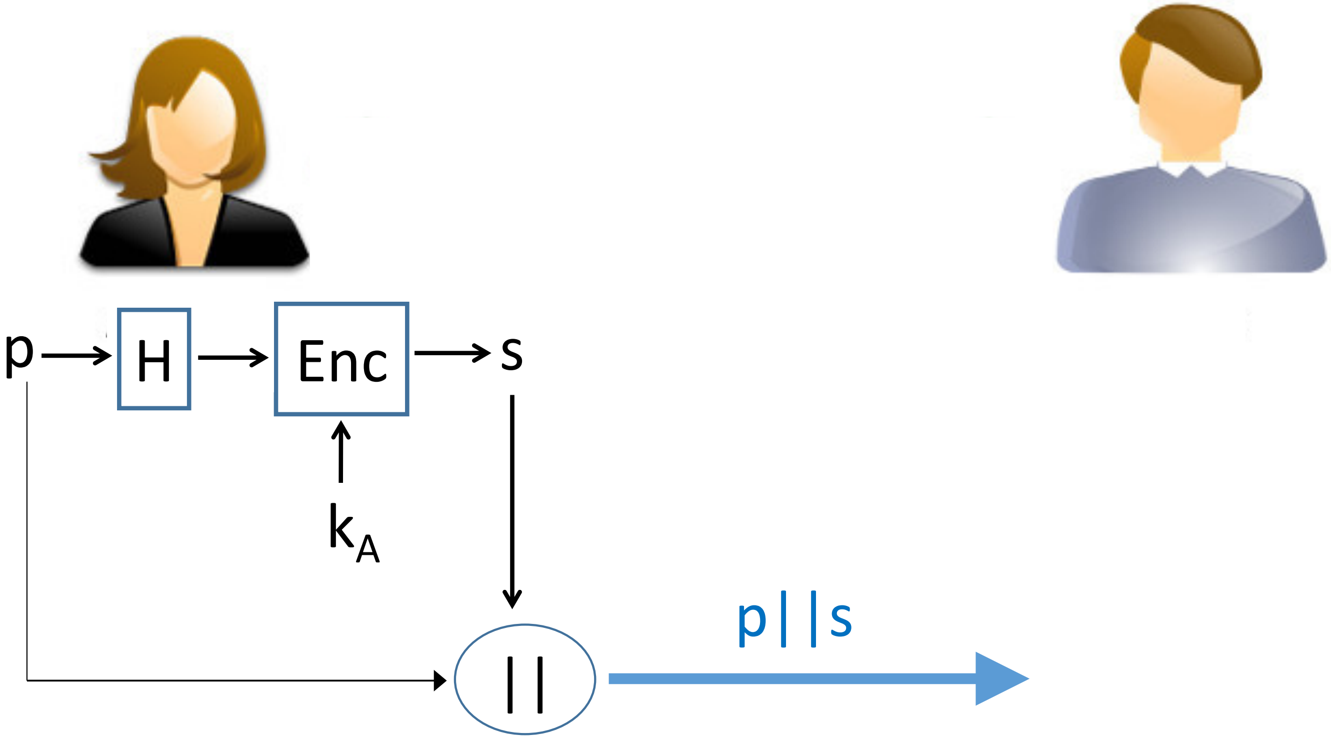
H

Enc

s

k_A

Digital Signature



p

H

Enc

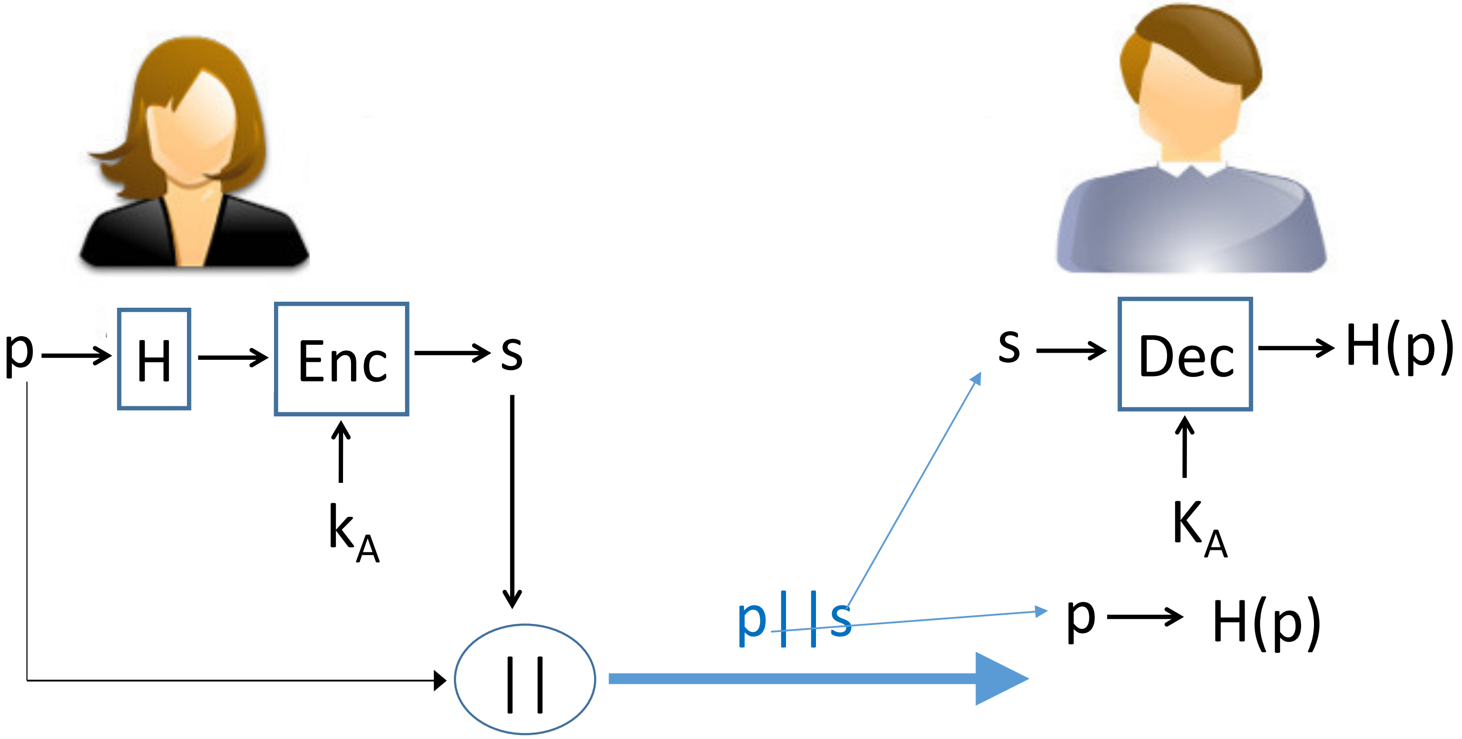
s

k_A

$||$

$p||s$

Asymmetric: Alice uses Alice's private key k_A



p → H → Enc → s

k_A

||

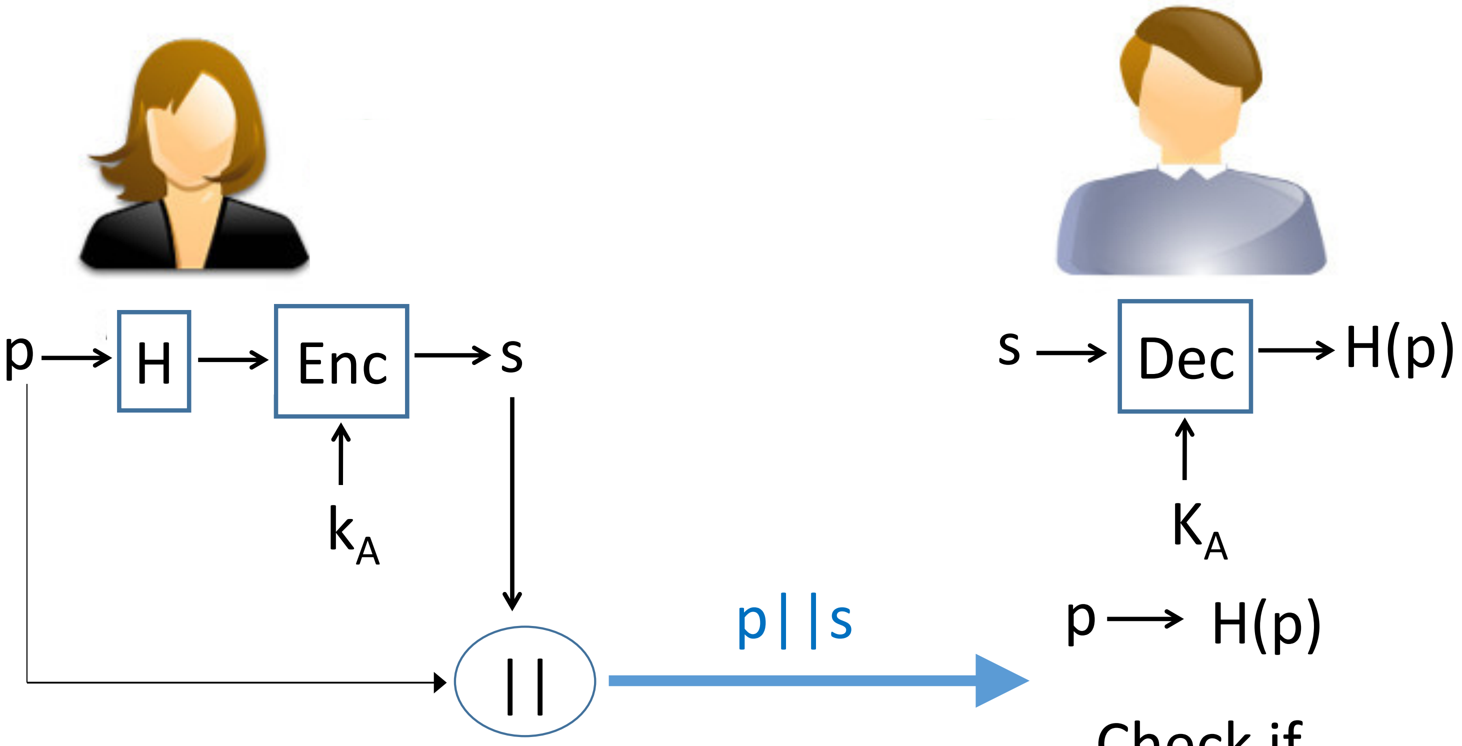
p||s

s → Dec → H(p)

K_A

p → H(p)

Asymmetric: Alice uses Alice's private key k_A



p → H → Enc → s

k_A

p || s

s → Dec → H(p)

K_A

p → H(p)

Check if
match?