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School of Electrical
Engineering

Basic Principles in Networking

Digital signatures and End Point Authentication

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Version 1.0

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Video: INTERVIEW – Elliptic curve cryptography (10 min)

How did NSA read our emails?

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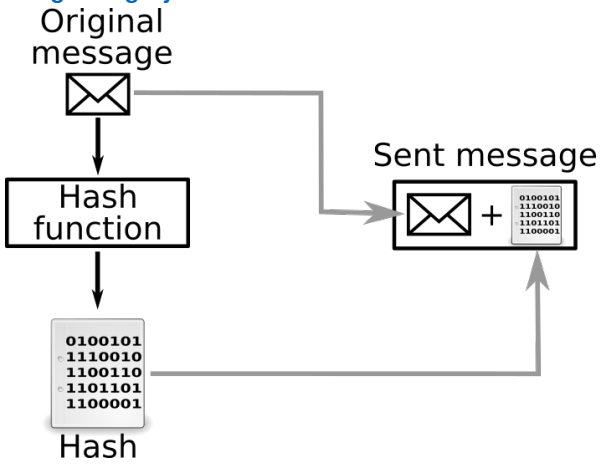
Part I (15 min)

Digital Signatures

Message Authentication codes

Use of hash functions to establish message integrity



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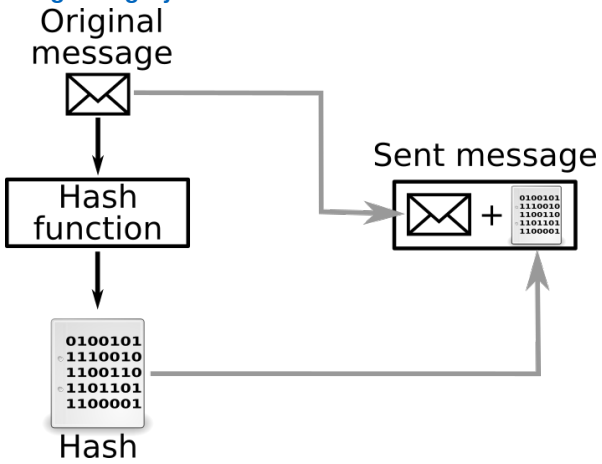

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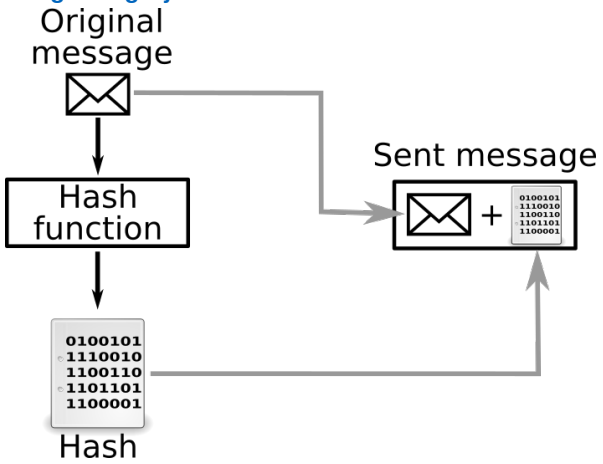

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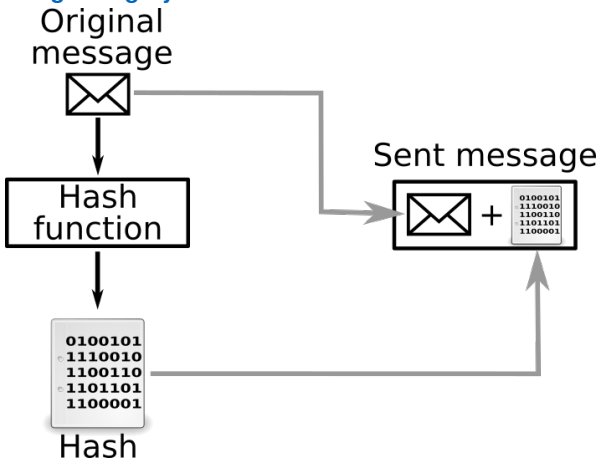

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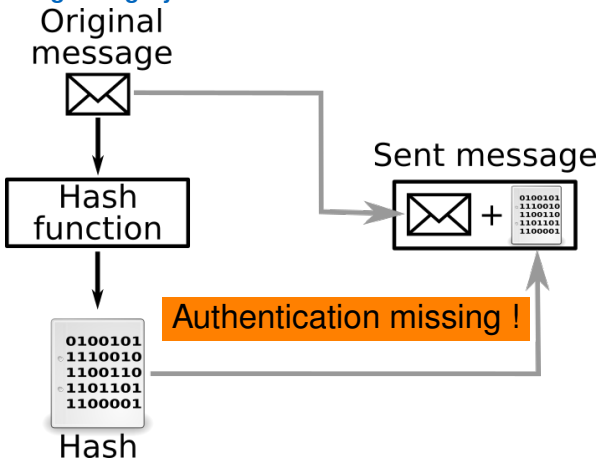

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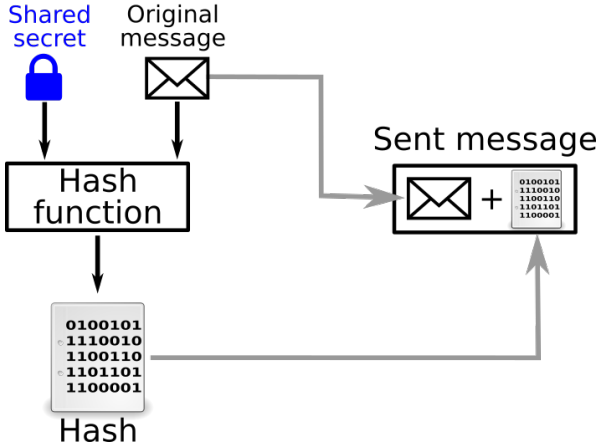

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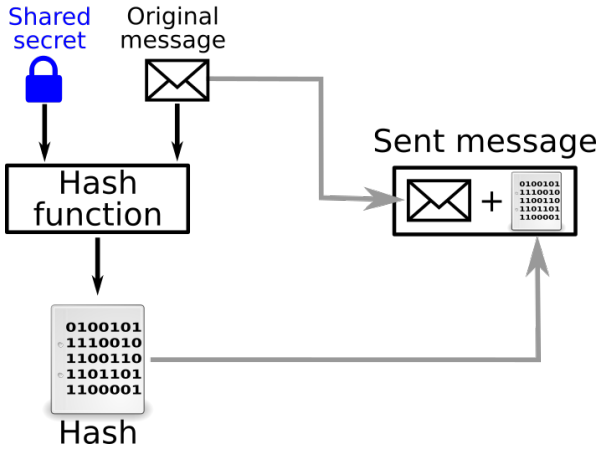

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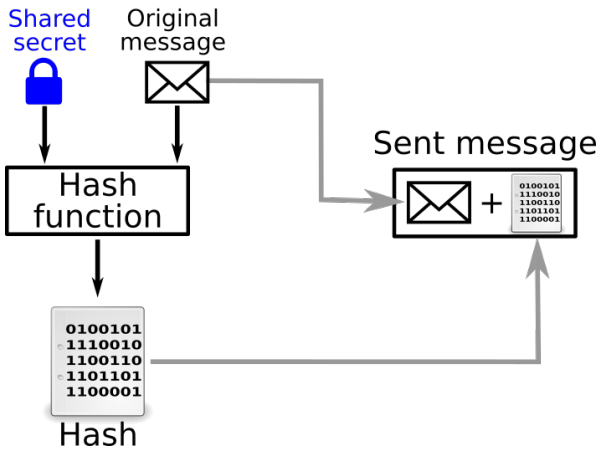

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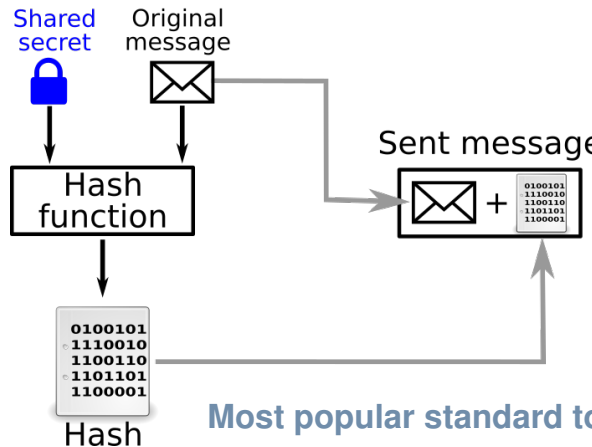

Most popular standard today: HMAC

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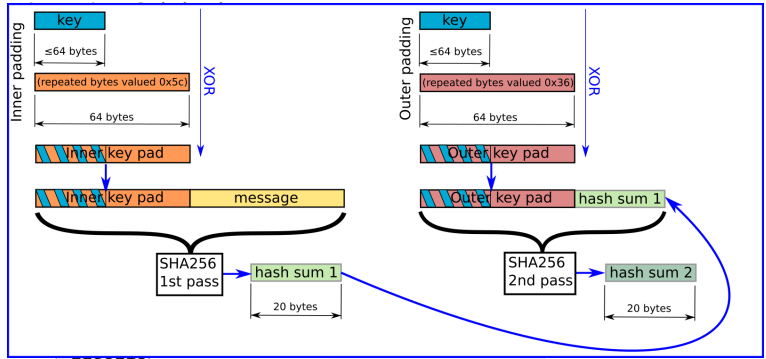

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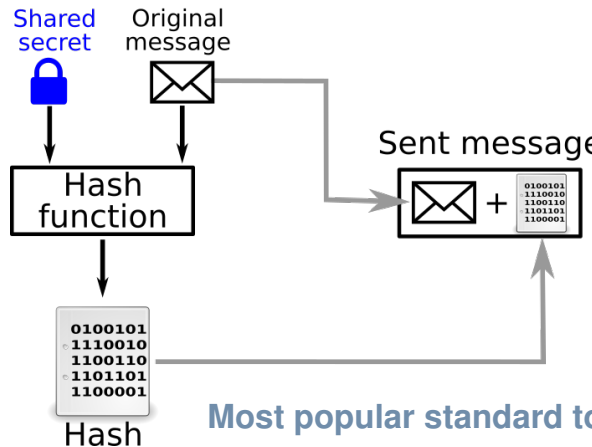

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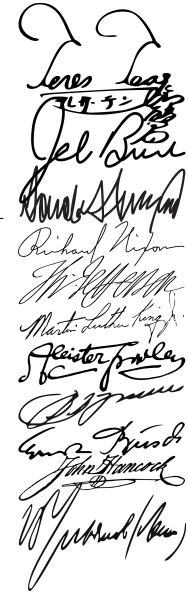
Digital signatures

A digital signature is a cryptographic technique to prove the identity of the owner/creator of a document or to signify one's agreement with a document's content



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Requirements for a digital signature

The signature must be unique to an entity in the network, verifyable and non-forgable

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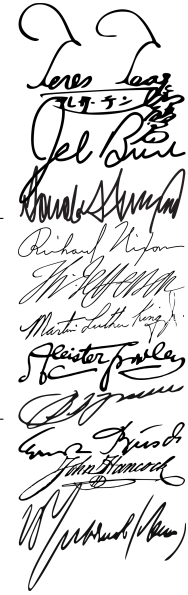

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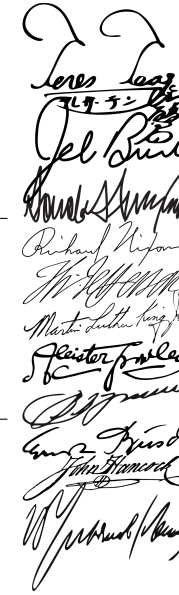

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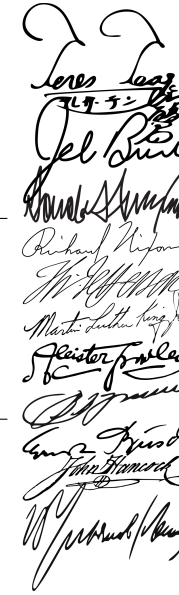

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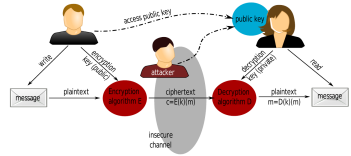
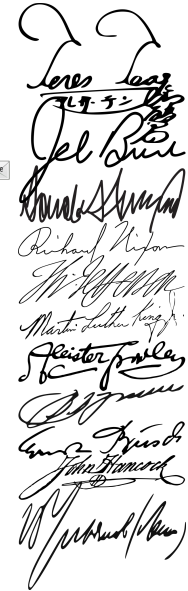
No: To verify the signature, the receiver needs a copy → not unique

Digital signatures

Asymmetric encryption for Digital Signatures





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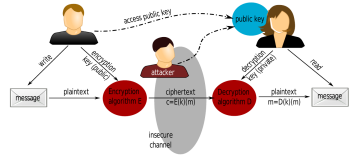

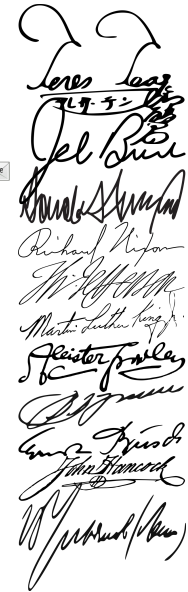

Signature is created by encrypting the message m with the private key: $K_B^-(m)$

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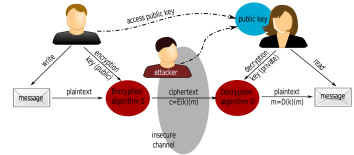

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Private key K_B^- unique to sender and can be verified by anyone with the public key: $K_B^+(K_B^-(m)) = m$

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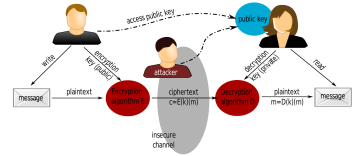

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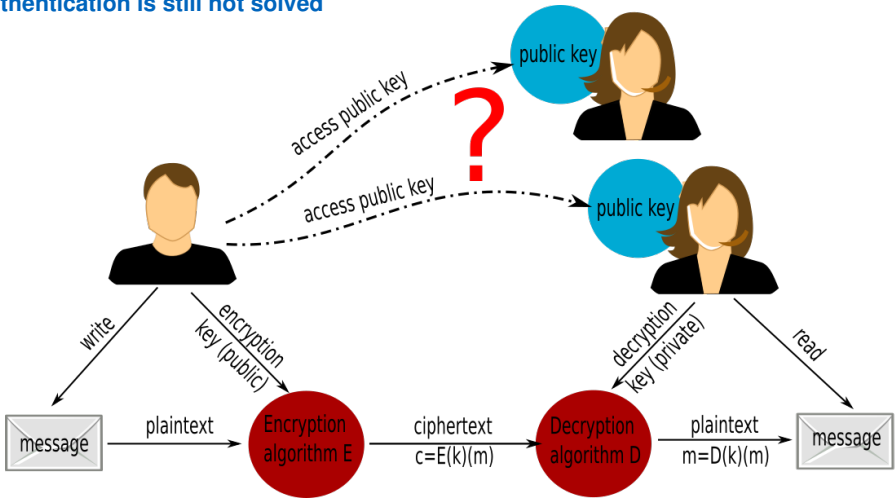
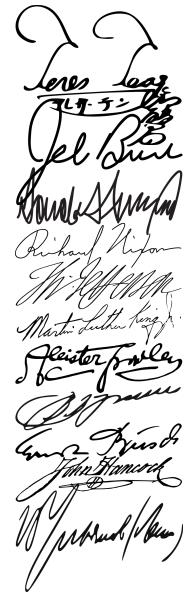
Non-forgable since it is *not computationally feasible* to find m' with $K_B^+(K_B^-(m)) = m'$

Digital signatures

Authentication is still not solved





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Part II (10 min)

End-point authentication

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Why is authentication difficult in networks?

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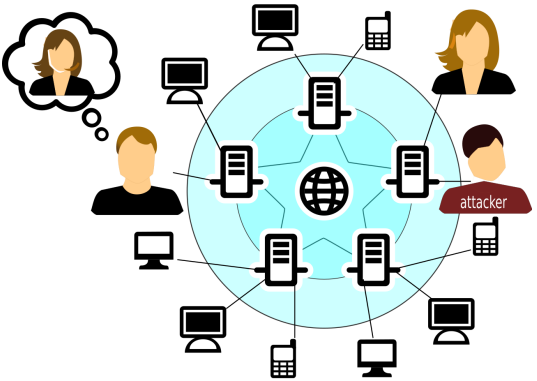
⇒ Unlike face-to-face communication, other party is 'invisible'



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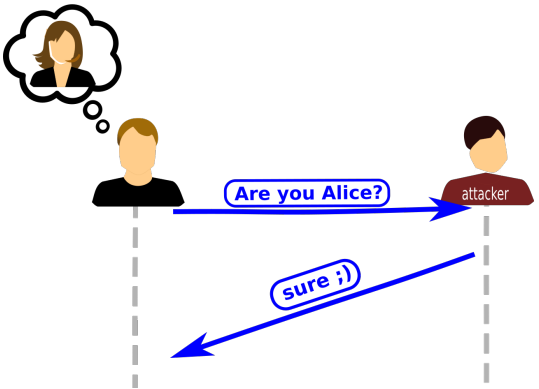

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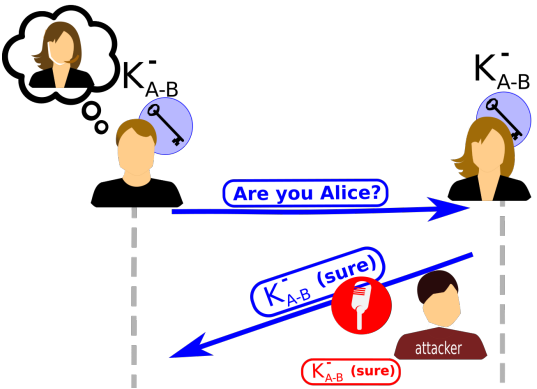

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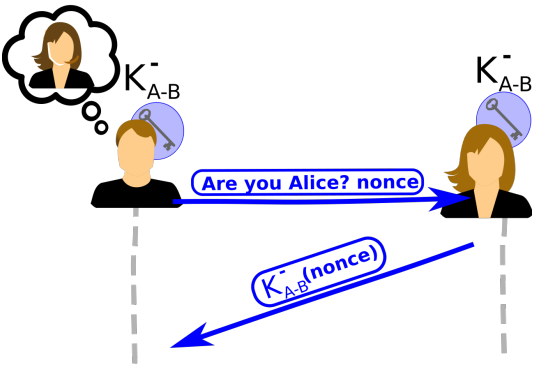
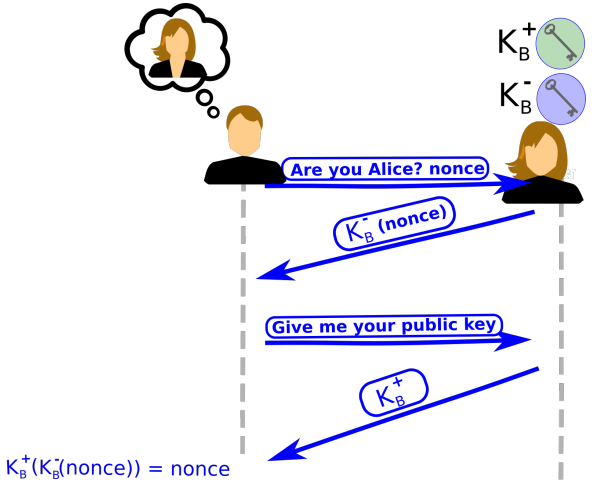


End-point authentication

Use asymmetric cryptography instead?



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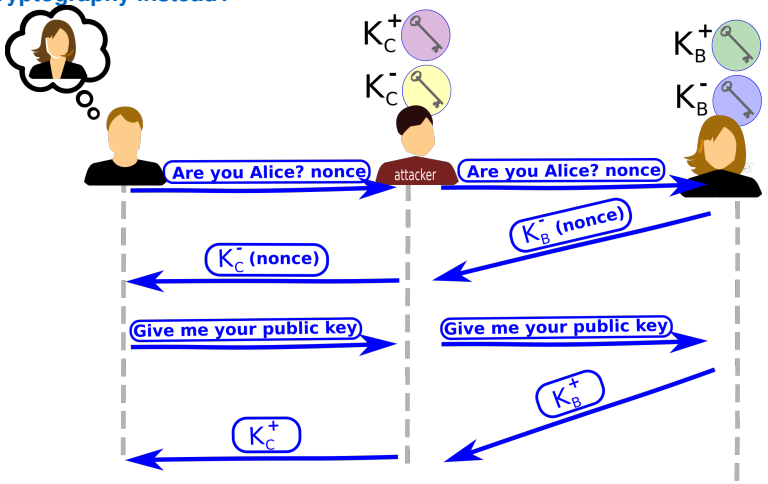
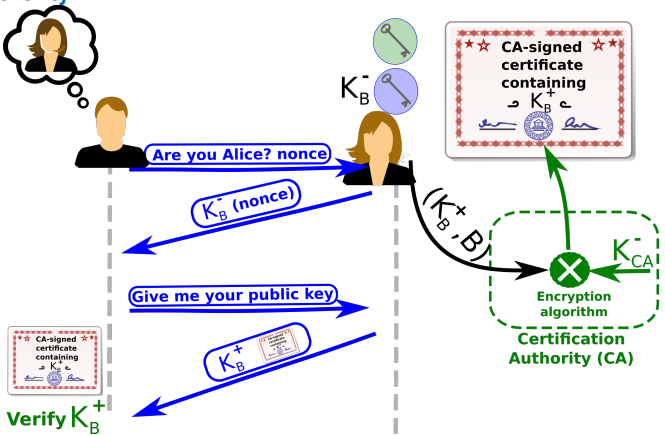


End-point authentication

Solution: Certified Authority



$\Rightarrow$ CA issued certificate contains K_B^+, B; digitally signed by K_{CA}^-

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Video: RSA 2016 – cryptographers panel (10 min)

Impact of the NSA-incident

Questions?

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Leo Lazar
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Literature

- J.F. Kurose,K.W. Ross: Computer Networking: A Top-Down approach (7th edition), Pearson, 2016.
- J.F. Kurose,K.W. Ross: Computer Networking: A Top-Down approach (6th edition), Addison-Wesley, 2012.