

Class Notes Oct 31 2017

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Finishing SAES example

End round 1: 0010 1110 0100 1011

Substitute(Feed into S-Box): 1010 1111 1101 0011

Put results from previous step into a matrix by filling down the rows $\begin{bmatrix} 1010 & 1101 \\ 1111 & 0011 \end{bmatrix}$

Shift columns $\begin{bmatrix} 1010 & 1101 \\ 0011 & 1111 \end{bmatrix}$

Read down columns: 1010 0011 1101 1111

xor with round key: 1000 0111 1010 1111

C= 0010 0100 0111 0000

AES:

10 Rounds

Skip mix columns in last round

128 bits of plain text

key is 128, 196 or 256 bits in length

Differential cryptoanalysis is faster than brute force for 7 rounds. For this reason 10 rounds was chosen to be secure against future attacks.

almost all secure internet traffic uses AES

The problem is you need the key to encrypt or decrypt. AES and DES are examples of symmetric key algorithms, i.e. both Alice and Bob need the key and if anyone finds the key then the system is compromised.

Big Innovation

Public key cryptography

Allows messages to be sent securely between two people who have no shared secret key

Public key cryptography

Relies on trap door problem

Trap door problem: math problem that is easy to do one way but very difficult the other way

Mathematician Rivest,Adelman and Shamir came up with RSA

Trap door problem: Factoring

Take two primes p,q

Easy to multiply $n = p * q$

Very hard to find p and q given n

Five steps to RSA

Alice will pick two prime numbers p,q (120ish digits in length)

$n = p * q$

She picks encryption exponent e (65537 is common)

She publishes (n,e)

Alice computes $\varphi(n) = (p-1)(q-1)$ (this is secret!)

Compute $d = e^{-1}(\text{mod } \varphi(n))$ using Euclids algorithm

d is the decryption key (secret)