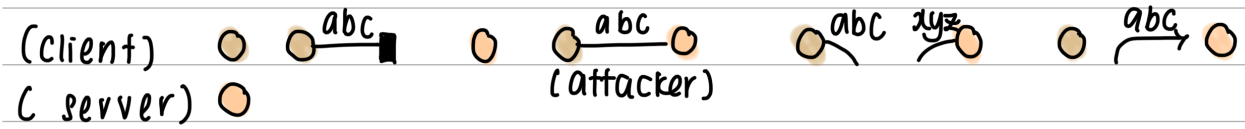
May

Security Taxonomy

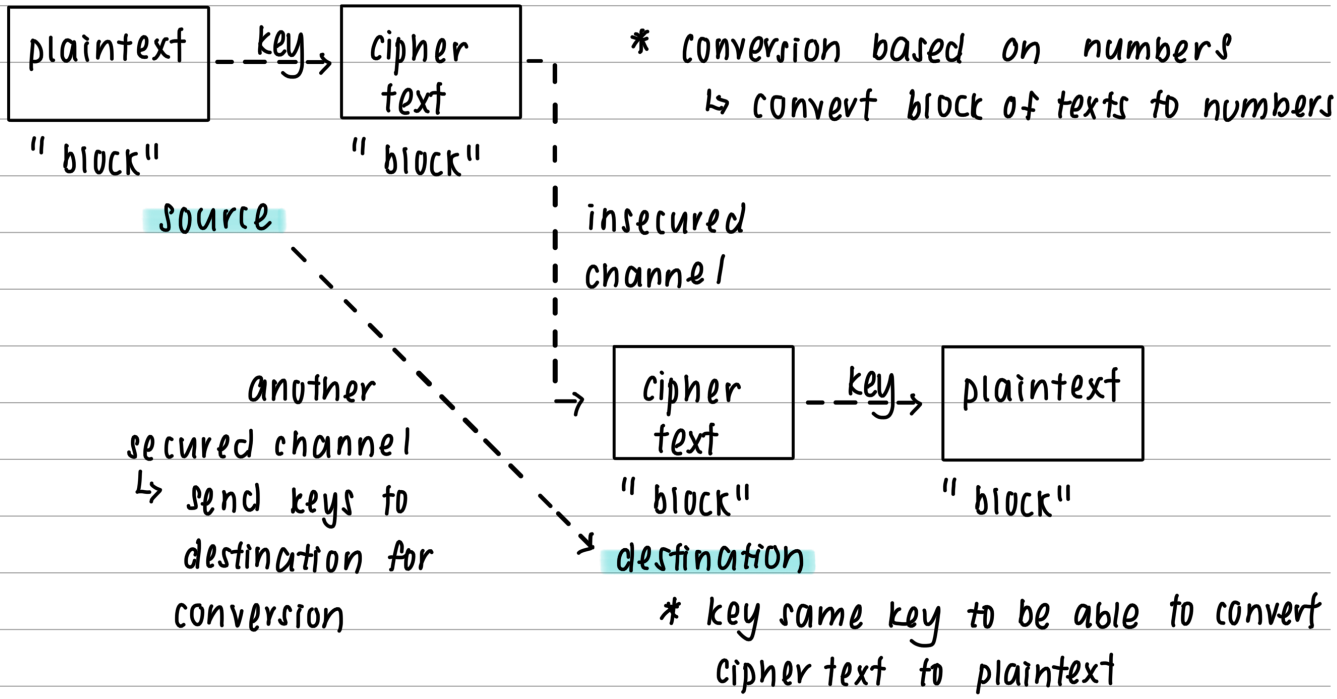
taxonomy : Interruption, Interception, Modification, Fabrication
security
properties : availability , privacy , integrity , authecity



Cryptography

- symmetric encryption
- public key cryptograph
- hashing algorithmn

Symmetric cryptography
↳ AES (eg. used in browsing server)



BUT!

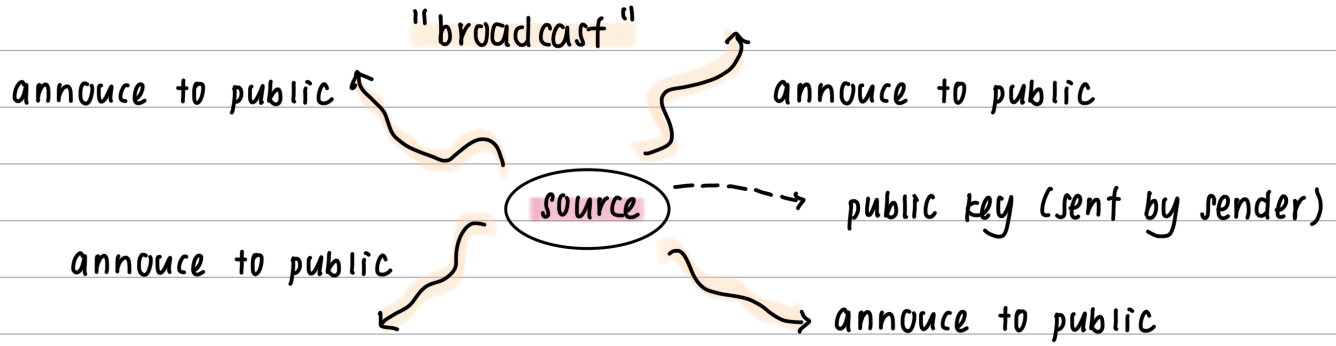
This method of sending keys from source to destination is unsecured
↳ if hacker found out there's another channel between, can hack the channel and get the key to convert cipher text to plaintext

(symmetric cryptography)
main problem : key exchange, confidentiality / privacy only,
scalibility ↳ X integrity, autencity
↳ ${}^{n}C_r$ ↳ X non-repiadility (?)
↳ ${}^{10}C_2$ vs ${}^{100}C_2$ vs ${}^{1000}C_2$
(45 keys) (4950 keys) (499520 keys)

public key cryptography
↳ asymmetric
↳ RSA

source · private key (encrypt)
· public key (decrypt)
↳ if private key is used to encrypt, public key is used to decrypt;
if public key is used to encrypt, private key is used to decrypt
↳ have a pair of keys
↳ can't use private / public key to encrypt and decrypt

* public key is annouced,
private key is kept



* if receiver wanna send a message to sender need use public key to encrypt message and send to original sender

"authencity" sender distribute certificate signed by sender's private key
↳ receiver with the certificate can access the server

Diffie - Hellman key Exchange (DHKE)
↳ exchange symmetric cryptography key through public key cryptography

Design RSA with $p=5, q=11$

① $p=5,\ q=11$ * normally millions = big numbers

② $N = p \times q = 55$

③ $\phi N = (p-1)(q-1)$
$= 4 \times 10$
$= 40$

④ public key, e ⟶ $1 < e < 40$
$\gcd(e, 40) = 1$
eg. $e \neq 20$ cus $40/20 = 2$, $20/20 = 1$
so $\gcd(20, 40) = 20$
so... $e = 7$; $\gcd(7, 40) = 1$
e can also be $= 3, 11, 13$ ... etc etc

⑤ private key, d
$d = \frac{\phi(N)(k-1)+1}{e}$ = integer

$d = \frac{40(k-1)+1}{7}$ ⟶ $\frac{40(5-1)+1}{7} = 161/7 = 23$

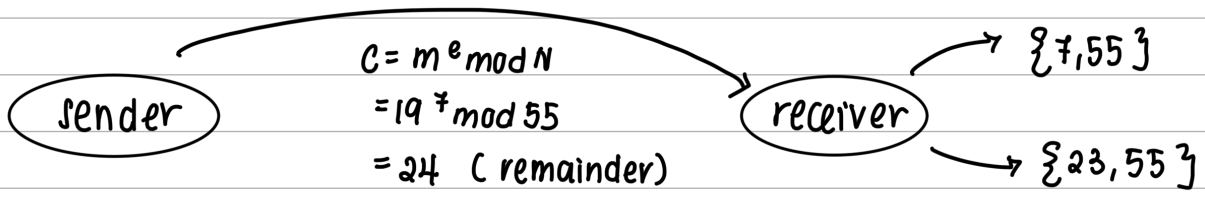
⋮

increase / decrease k value until d = integer (whole number)

⑥ $KU = \{e, N\}$; $KR = \{d, N\}$
$= \{7, 55\}$ $= \{23, 55\}$

Encrypt 19 using public key & decrypt using private key

* RSA ⇒ $N > m$, larger N = encrypt larger message



$C = m^e \bmod N$
$= 19^7 \bmod 55$
$= 24$ (remainder)

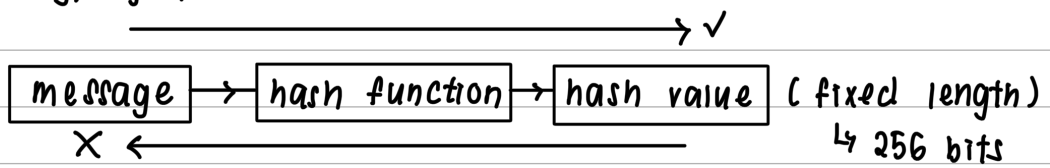
* m = message = 19
* $e = 7$
* $N = 55$

$m = c^d \bmod N$
$= 24^{23} \bmod 55$
$= 24^5 \bmod 55 \times 24^5 \bmod 55 \times 24^5 \bmod 55 \times 24^5 \bmod 55 \times 24^3 \bmod 55$

54^4 ~~mod 55~~ / $24^3 \bmod 55$

the message
will do until 19
$54^4 \times 19 \bmod 55 \leftarrow 54^4 \times 24^3 \bmod 55$
mod 55 until lesser than 55

Cryptographic Hash Function



* hash algorithmn
  ↳ MUST BE FAST & EFFICIENT
  ↳ GENERATE IMMEDIATELY
* give hash value, original message can't be found
* almost similar function have huge difference in hash value
* same message = same hash value
* collision resistant
  ↳ 2 different message will not result in same hash value

Authencity (store password)	Integrity (store document) ↳ document context
Username : abc password : 123 username (IP) | password (hash value) hash function ↓ hash value ↓ X same	