Lecture 17

Web Security

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Outline

- **Web security overview**
- **Secure transmission of data**
- **User's security issues**
- **Service provider's issues**

1. Web security

- **Web client expect web applications to be secure**
  - **preventing access from untrusted or malicious sources to private data**
  - **service providers do not misuse their data**
    - **by exchanging data with third party**

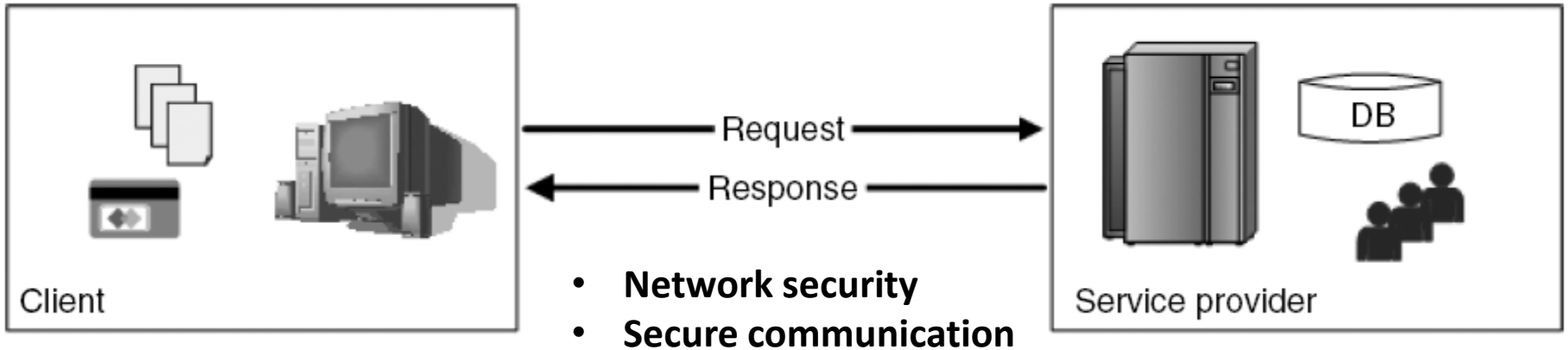
1. Web security…

- **Several risks exist for service providers as well**
  - **prevent access from attackers**
    - **credit card number can be stolen**
    - **data can be accessed and modified**
  - **availability of service can be reduced**
- **can influence agreements and cause financial lose**

1. Web security…

- **We can define security according to notions of users and service providers as**
  - **securing the end user's computer and personal data stored on it**
  - **securing information in transit**
  - **securing the server and data stored on it**

1. Web security…



- **Desktop security**
- **Security of personal data**

- **Network security**
- **Secure communication**

- **security of the host**
- **Service availability**

1. Web security…

- **Security aspects**
- **Confidentiality:**
  - **means communication between a customer and a provider cannot be read by a third party**
    - **data encryption can be used**
- **Integrity:**
  - **nobody is able to modify the exchanged information**

1. Web security…

- **Security aspects**
- **Non-repudiation:**
  - **originators of messages should not be able to deny**
    - **customers ordering books at an online store**
- **Authentication:**
  - **the process of verifying the identity of a person or general subject such as another application invoking a service on behalf of a human user**
  - **usually implemented by login/password mechanism**

1. Web security…

- **Security aspects**
- **Authorization**
  - **is used to infer which privileges authenticated users are granted**
- **Availability**
  - **guaranteeing the availability of Web applications**
    - **service downtime typically implies financial losses**

1. Web security…

- **Security aspects**
- **Privacy**
  - **privacy demands the reliable handling of data**

2. Data encryption

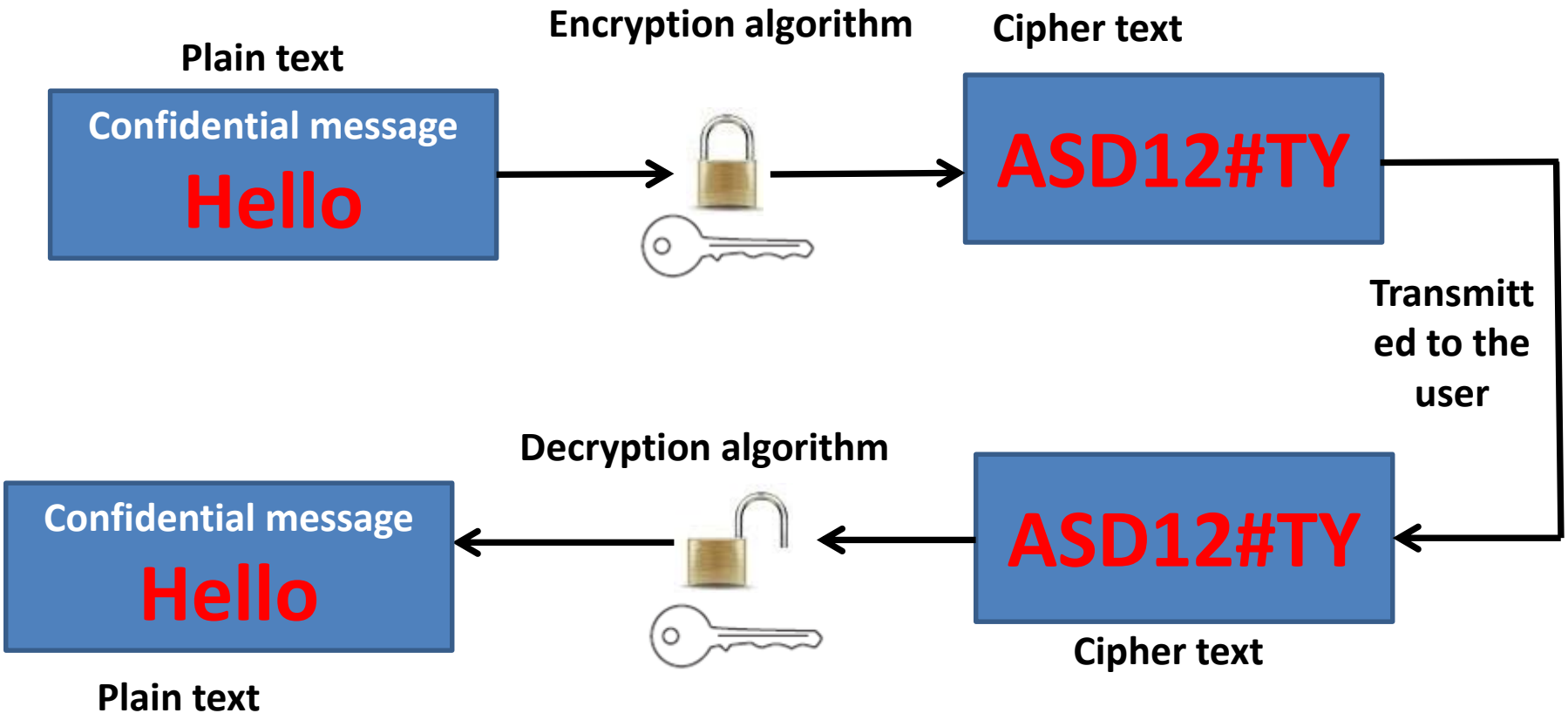
- **Encryption is a basic technology for enabling secure messaging**
- **Encryption :**
  - **translation of data into a format that is intended to be unreadable by anyone except the intended party**
  - **changing the original text to a secret message using mathematical function**
    - **one-way encryption**
    - **two-way encryption**

2. Data encryption…

- **Decryption:**
  - **changing the secret message back to its original form**

2. Data encryption…

- **Encryption/decryption process:**



2. Data encryption…

- Used by Julius Caesar
- Caesar shifted each letter of his messages to his generals three places down in the alphabet
- So BURN THE BRIDGE becomes
- EXUQ WKH EUKFIG

A ⇨ D
B ⇨ E
C ⇨ F
D ⇨ G
E ⇨ H
F ⇨ I
G ⇨J
H ⇨ K

2. Data encryption…

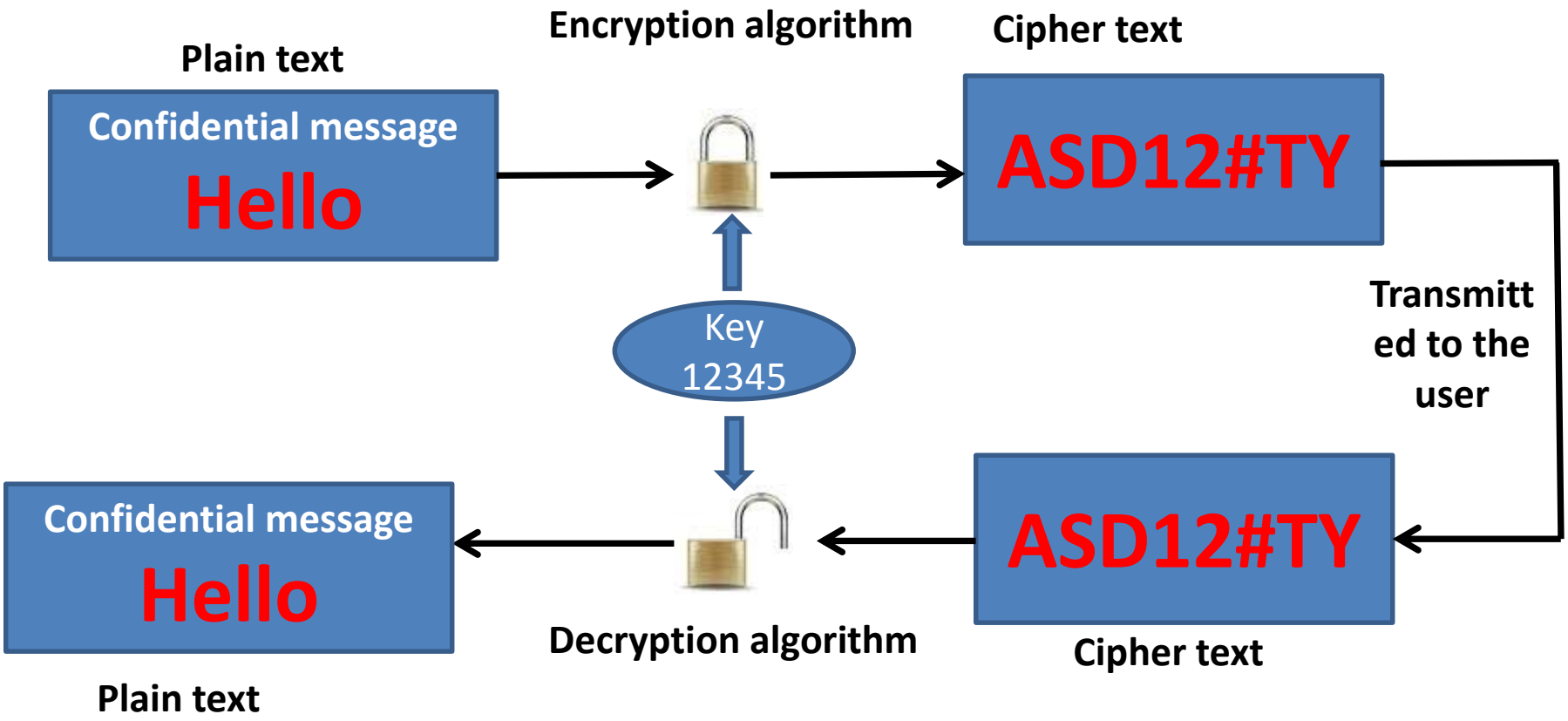
- **Cryptographic algorithms:**
- **Rely on keys as secret term for ciphering and deciphering**
- **Without key it is computationally impossible to break an algorithm**
- **An algorithm is considered strong if brute force attack is the only possible attack**

2. Data encryption…

- **Symmetric cryptography:**
- **Two-way encryption**
- **Use the same single key to encrypt and decrypt a message**
- **Also called private key cryptography**
  - **DES and AES are examples of symmetric cryptographic algorithms**

2. Data encryption…

- **Symmetric cryptography:**

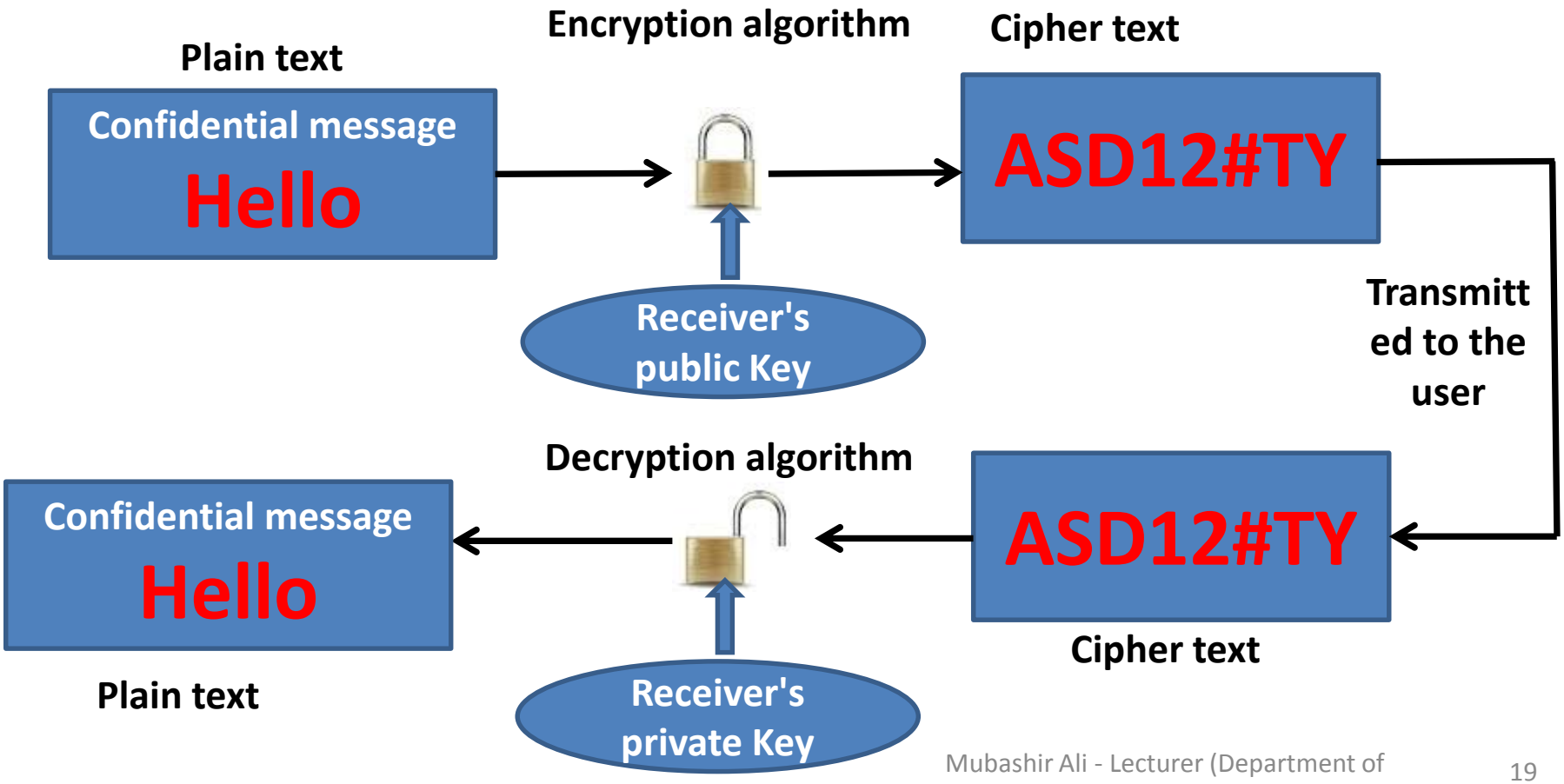


2. Data encryption…

- **Asymmetric cryptography:**
- **Also known as public key cryptography**
- **Uses two keys instead of one**
  - **The public key is known to everyone and can be freely distributed**
  - **The private key is known only to the recipient of the message**
- **RSA is an example of asymmetric cryptography**

2. Data encryption…

- **Asymmetric cryptography:**



2. Data encryption…

- **Hashing algorithms:**
- **Hashing is a one-way process**
  - **converting a hash back to the original data is difficult or impossible**
- **A hash is a unique "signature" for a set of data**
  - **this signature, called a hash or digest, represents the contents**

2. Data encryption…

- **Digital signatures:**
- **A digital signature is basically a way to ensure that an electronic document is authentic**
  - **Integrity**
  - **Non repudiation**

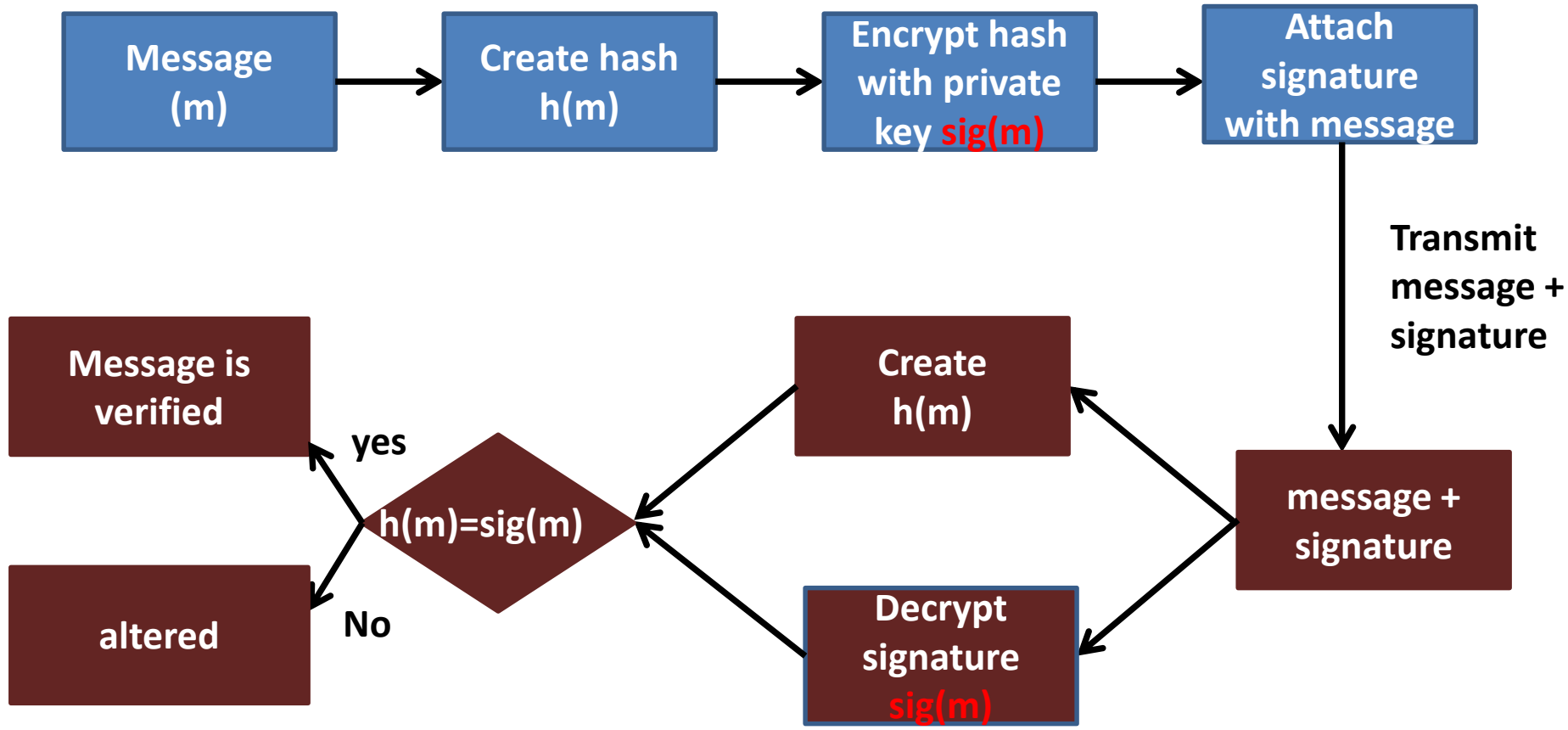
2. Data encryption…

- **Digital signatures creation:**
- **sender creates a hash of the message**
- **sender encrypts the message with his/her private key**
- **attach the digital signature with message**

2. Data encryption…

- **Digital signatures validation:**
- **Receiver decrypts the signature with sender's public key**
- **Receiver creates the hash of the message**
- **Created hash is compared with the decrypted message**

2. Data encryption…



3. Data encryption….

- **Cryptography ensures**
  - **Confidentiality**
  - **Integrity**
  - **Availability**
  - **Authenticity**
  - **Non-repudiation**

3. Securing user's data

- **After securely transmitting data user wants**
- **Privacy**
  - **providers keep data carefully**
  - **protect data from attackers**
- **Secured desktop**

3. Securing user's data…

- **Service providers need to establish trust relationship**
  - **can specify data practices using platform for Privacy Preferences (P3P) standard**
- **User can specify its preferences using P3P-agent**
- **P3P-capable browsers inform the user if service provider's policies conflict with user's preferences**

3. Securing user's data…

- **Phishing and Web Spoofing**
- **Phishing is the most common attack to retrieve user's personal information**
- **Web spoofing denotes mocking the web presence of famous companies**
  - **send email to users as representative of some well known company**
  - **encourage the user's to enter their personal information**

3. Securing user's data…

- **Securing the desktop**
- **users' security can be at-risk through threats like viruses and worms**
  - **it is user's responsibility to tackle with them**

3. Securing user's data…

- **Adware and spyware**
  - **adware deliver advertising contents**
  - **spyware monitor users activities and transfer gathered information to remote systems**
- **Remote access/backdoors**
- **provide remote systems the ability to connect with user's machine**
  - **can obtain personal information, damage files and control user's machine**

3. Securing user's data…

- **Viruses**
- **can damage files or repeat themselves**
  - **distributed through email or by sharing infected files**
- **Worms**
- **Repeat themselves**
  - **increase traffic and consume processing power**

3. Securing user's data…

- **Trojan horses**
- **Damage files but don't replicate**
- **Appears as useful programs but performs other functionalities**
  - **aims at data theft and destruction or illegitimate access on computational resources**

4. Service providers issues

- **Service provider wants to secure the server from attackers**
- **Common attacks:**
- **Cross-site scripting (XSS)**
- **Attackers inject script in dynamically created pages and try to find user's information**
- **SQL-injection**
- **Attackers inject sql commands as an input**

Summary

- **Web security overview**
- **Secure transmission of data**
- **User's security issues**
- **Service provider's issues**

References

- **Chapter 13, Kappel, G., Proll, B. Reich, S. & Retschitzegger, W. (2006). Web Engineering, Hoboken, NJ: Wiley & Son**