

Announcements

- ❖ Check class announcements daily
- ❖ You must implement programming projects by yourself

Security (Email)

- ❖ Least secure of internet protocols
- ❖ Avoid sending sensitive information (e.g., passwords) over e-mail
- ❖ Provide e-mail addresses in web sites in a way is not easily recognized by spam programs
 - ❖ Use at rather than @
 - ❖ Put an image with the e-mail
 - ❖ Avoid mailto
- ❖ Encrypt the message using PGP (Pretty Good Privacy) or GPG (GNU Privacy Guard)
- ❖ <http://www.wbwip.com/wbw/emailencoder.html>

Security (Password-Protected Sites)

❖ **Approach not recommended**

- ❖ Store encrypted password
- ❖ Decrypt password and compare against user provided password

❖ **Better approach**

- ❖ Store encrypted password
- ❖ Encrypt provided password and compare against stored password

Security (Encryption)

- ❖ **Encryption** → process of converting plaintext into ciphertext
- ❖ **Decryption** → process of converting ciphertext into plaintext
- ❖ **Symmetric cryptography** → sender and receiver share the same key
- ❖ **Asymmetric (Public Key) cryptography** → sender and receiver have different, complementary keys
- ❖ **Symmetric cryptography**
 - ❖ Example algorithms: DES, Triple-Des, RC4.
 - ❖ Relatively fast compared to asymmetric
 - ❖ Drawbacks
 - ❖ Keys must be change frequently
 - ❖ How to distribute the key safely

Security (Encryption)

- ❖ **Branches of public key cryptography**
 - ❖ **Public key encryption**
 - ❖ **Digital signatures**
- ❖ **Public key Encryption**
 - ❖ Example algorithm: RSA
 - ❖ Relatively slowed compared to symmetric
 - ❖ How it works?
 - ❖ Each user has a public/private key pair.
 - ❖ Public key is widely known
 - ❖ Private key only known by user that generated it
 - ❖ If user A wants to send user B a message, user A encrypts message with B's public key. B will decrypt the message with B's private key. The only way to decrypt the message is by using B's private key
- ❖ **Digital signature**
 - ❖ Message signed with sender's private key can be verified by anyone with sender's public key thereby proving message authenticity

Digital Certificates (Certificates)

- ❖ **Digital Certificates** → electronic documents that contain information about a public key and the owner (name, address, etc.)
- ❖ Employed to verify a public key corresponds to a particular organization
- ❖ Certificates must be issued by a trusted third party known as certificate authority (CA) which guarantees the information is correct
- ❖ **About certificates**
 - ❖ Have a validity period and can expire
 - ❖ They can be revoked
 - ❖ Browsers have a collection of root certificates
 - ❖ In Firefox – Tools → Options → Advanced → View Certificates
 - ❖ Main standard X.509

Message Digests

- ❖ Message digest → fixed-length representation of a message
- ❖ Expected properties for message digest (“Hashing”) algorithm
 - ❖ Original message cannot be obtained from the digest
 - ❖ Two different messages should have different digests
- ❖ Example algorithms: MD5 and SHA

Need For Security

- ❖ **SSL (Secure Sockets Layer) Protocol** → Protocol that enable us to satisfy the need for security in client-web server transactions
- ❖ The algorithm provides support for confidentiality, integrity and authentication
- ❖ **SSL connection is established as follows:**
 - ❖ User connects to web server through the browser
 - ❖ Browser and server exchange public keys and certificate information
 - ❖ Browser checks server certificate validity (certificate not expired, issued by CA, etc.)
 - ❖ Optional: server can request a valid certificate from the client
 - ❖ Using public keys server and client determine a symmetric key to use
 - ❖ Communication from this point on is through symmetric cryptography

https

- ❖ **https** → http where
 - ❖ A different default port (443) is used
 - ❖ An extra layer of encryption/authentication exists between HTTP and TCP
- ❖ **https** → is not a separate protocol but a combination of HTTP over encrypted SSL or TLS transport mechanism
- ❖ **TLS** → Transport Layer Security
 - ❖ IETF standard designed to standardize SSL as an Internet protocol
 - ❖ Slight differences between SSL 3.0 and TLS 1.0

Social Consequences of Security

- ❖ Recent report on how social security numbers can be predicted
- ❖ Confidentiality of medical information
- ❖ National Security Information
- ❖ What other scenarios can you think of?

Security Sites

- ❖ www.securityfocus.com/
- ❖ www.cert.org/