CIS 551 / TCOM 401

Computer and Network Security

Spring 2006

Lecture 25

Announcements

- Project 3 due TOMORROW
  - Updated web pages now have a UDP trace for testing
  - Unfortunately, no course staff available for last-minute help.

- Final exam:
  - May 5th.
  - 9:00 - 11:00 a.m.
  - Moore 216.
  - Cumulative, but concentrated on material since Midterm II.

Plan for today

- Wrap up digital cash (briefly)
- General course overview & conclusions
  - discussion
- Course evaluations

Digital Cash (1)

- Alice prepares 100 anonymous money orders for $1000 each. Each includes a different nonce.
- Alice puts all 100 anonymous money orders, and a piece of carbon paper, into 100 different envelopes. She sends all of them to the bank.
- The bank opens 99 envelopes and verifies that each is a money order for $1000.
- The bank signs the remaining unopened envelope and the signature is copied on to the money order. The bank hands the money order back to Alice and deducts $1000 from her account.

Digital Cash (2)

- Alice opens the envelope and sends the (signed) money order to the merchant.
- The merchant verifies the bank's signature to make sure the money order is legititmate.
- The merchant takes the money order to the bank.
- The bank also verifies the signature and checks a database to make sure that a previous money order with the same nonce has not been used. If it hasn't the bank credits $1000 to the merchant and records the nonce.
- If the nonce is present, the bank rejects the order.

Main Take-away Ideas (1)

- Security is about Tradeoffs
  - Balance risk vs. expense

- *Principles of Secure System Design:*

- Security is a process
- Least privileges
- Complete Mediation
- System Design
  - Economy of mechanism
  - Open standards
  - Failsafe Defaults

Main Take-away Ideas (2)

- Cryptography is important…
  - Can be used for more than just hiding information
  - Authentication and integrity

- … but not the only facet of security
  - Other risks
  - Social engineering is effective
  - Cryptography applied inappropriately is useless

- So: use it where necessary, and use it correctly
  - See Schneier’s book *Applied Cryptography*

Main Take-away Ideas (3)

- Concepts of security:
  - Confidentiality
  - Integrity
  - Availability

- General Mechanisms
  - Authentication
    - Challenge / Response
  - Authorization
    - Reference monitors
    - Access control matrices
  - Audit
    - Logs

Main Take-away Ideas (4)

- Cryptography & Protocol Design
  - Shared vs. Public key cryptography
- Cryptographic protocols can be used for:
  - Authentication, privacy, confidentiality
- Challenge—Response is the fundamental method of authentication
- Nonces, Time stamps, Sequence numbers prevent replay attacks

Main Take-away Ideas (5)

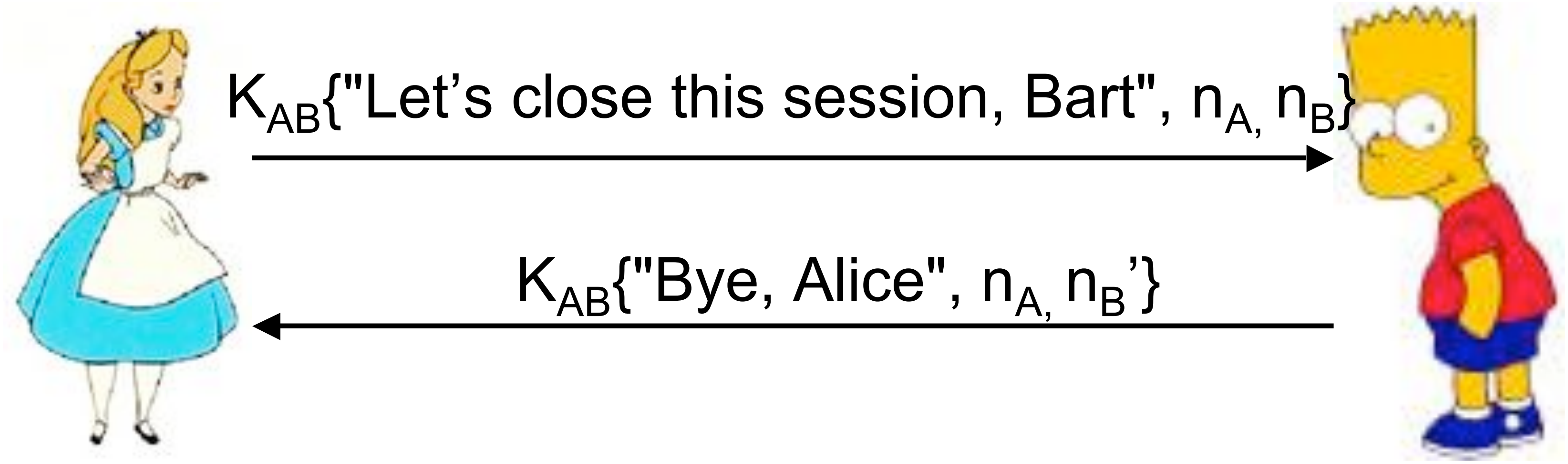
- Malicious Code
  - Viruses & Worms
  - Defense in depth: patching, firewalls, proper configuration, auditing

- Buffer overflows are the #1 vulnerability
  - Choose safe languages:
    - Java, C#, Scheme, ML
  - Be aware of format string and input errors, take care when writing programs and scripts.
  - Software audit and design is important.
  - If you must use C or C++, use StackGuard, ProPolice, or another buffer-overflow preventative measure.

Further study

- Advanced cryptography & cryptographic protocols
  - Elliptic curves
  - Protocol analysis - logic and model checkers
  - Secret sharing, voting
- Systems security
  - Fault tolerance: replication, consensus algorithms
- Additional sources of information (research literature):
  - IEEE Symposium on Security & Privacy ("Oakland conference")
  - ACM Conference on Computer and Communications Security
  - Computer Security Foundations Workshop
  - CRYPTO, EUROCRYPT

Thanks!



K_{AB}\{"Let’s close this session, Bart", $n_{A,}$ n_B\}

K_{AB}\{"Bye, Alice", $n_{A,}$ n_B’\}