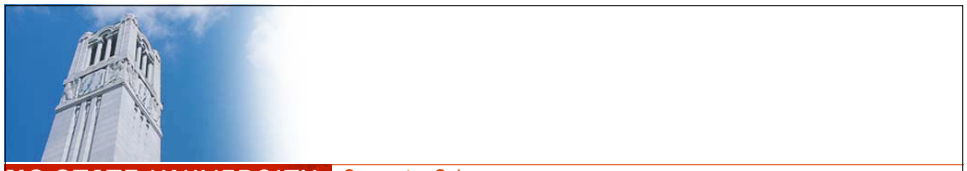


NC STATE UNIVERSITY Computer Science

CSC 774 Advanced Network Security

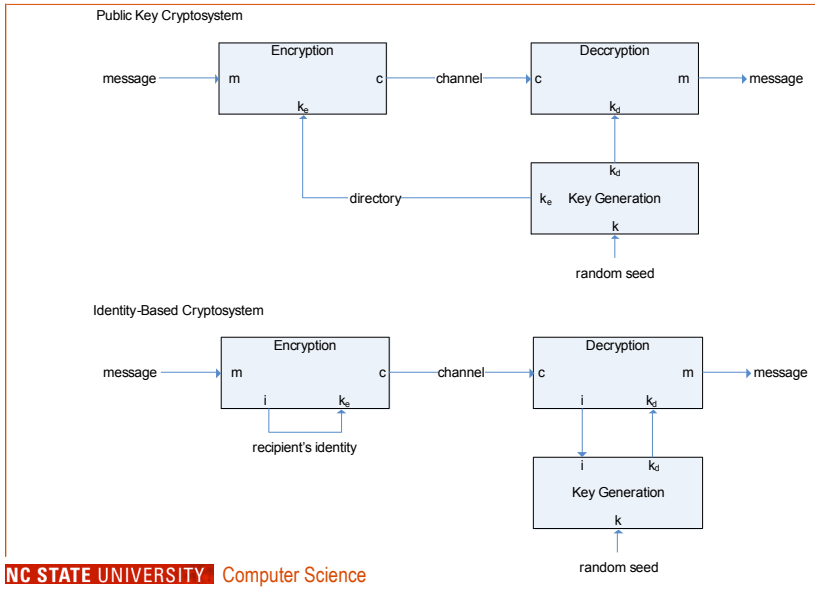
Topic 2.6 ID Based Cryptography

Slides by An Liu

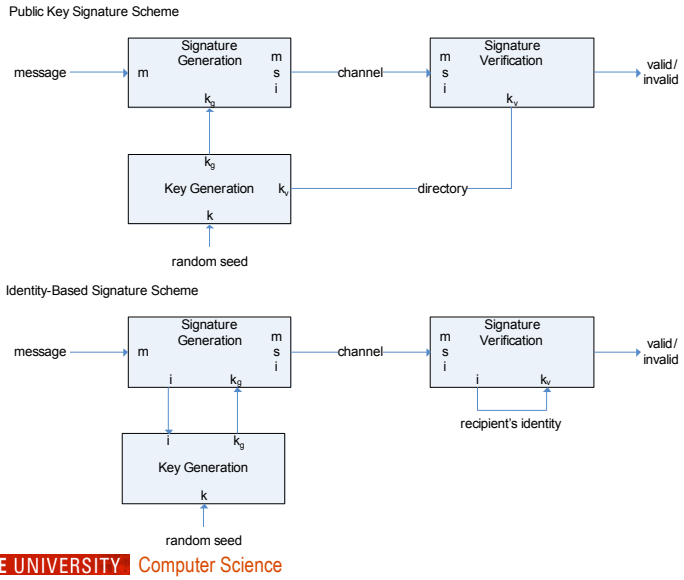
Basic Idea

- Use identity as the key for encryption and signature verification.
  - No key directory needed.
- Trusted key generation center (KGC)
  - Give each user a smart card when user first joins the network.
  - Each user uses the secrete key in smart card for decryption and signature verification.
  - KGC can be closed after all cards are issued.

Basic Idea (Cont'd)



Basic Idea (Cont'd)



Security

- The security of underlying cryptographic functions.
- The secrecy at KGC.
- Identity check before issuing cards to users.
- The loss, duplication and unauthorized use of cards.

Implementation of Signature Scheme

- KGC chooses three public parameters. The factorization of n is only known by KGC.
  - $n=p \cdot q$, p and q are large primes
  - e, which is relatively prime to $\varphi(n)$
  - f, which is one way function
- The secrete key corresponding identity i is g
  - $g^e = i \pmod{n}$
  - KGC can compute g easily. Why?

$$ed \equiv 1 \pmod{\varphi(n)}$$

$$i^d = (g^e)^d \pmod{n} = g$$

Signature Generation and Verification

- Signature generation
  1. Choose random number r
  2. $t = r^e \pmod{n}$
  3. $s = g \cdot r^{f(t,m)} \pmod{n}$
  4. Signature is (t, s)
- Signature verification

  $s^e = i \cdot t^{f(t,m)} \pmod{n}$

  $s^e = g^e \cdot r^{e \cdot f(t,m)} \pmod{n}$

Misc

- Multiplicative relationship between the identities will introduce same relationship between secret key.
  - Expand identity to pseudo-random string
- r cannot be reused or revealed