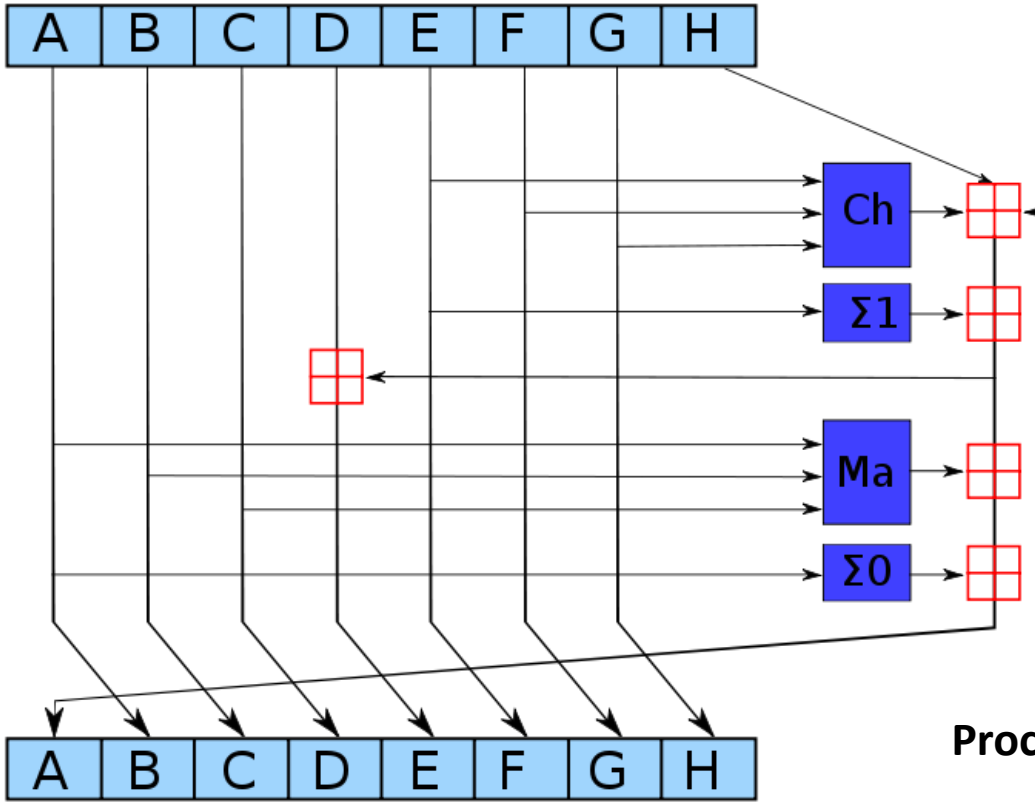
Security II

CS 241

Dec. 6, 2013

SHA2

- SHA2 is a **public** algorithm
  - ***Security in the mathematics, not in keeping the implementation a secret***



$$\mathrm{Ch}(E,F,G) = (E \wedge F) \oplus (\neg E \wedge G)$$

$$\Sigma_1(E) = (E \ggg 6) \oplus (E \ggg 11) \oplus (E \ggg 25)$$

$$\mathrm{Ma}(A,B,C) = (A \wedge B) \oplus (A \wedge C) \oplus (B \wedge C)$$

$$\Sigma_0(A) = (A \ggg 2) \oplus (A \ggg 13) \oplus (A \ggg 22)$$

Process the entire message, 64 times.

SHA2

- Right now, SHA2 is considered a secure hash.
  - ***Mathematics have not been broken***
  - ***The complexity of reversing a hash would take more computing power than has ever been created***
  - SHA2 has several variants based on the length of the output desired: SHA-256 (256-bit output) is most common.

Other Algorithms

- **MD5** (1991):
  - 2005-2008: MD5 was mathematically simplified and available processing power could fake hashes
  - *"should be considered cryptographically broken and unsuitable for further use"*
- **SHA-0** (1993):
  - 1998: Was shown to be easily simplified; some hashes can be reversed in less than an hour!
- **SHA-1** (1995):
  - Replacement to concerns about SHA-0
  - 2005: Theoretical attack developed showing some weakness in the mathematics (reverse in <= 2^{69})

Sharing a Secret

- Diffie–Hellman Key Exchange
  - Secure algorithm with large numbers
  - Demonstrates the basics of how SSL works

- Setup:
  - Two parties: Alice and Bob
  - Alice and Bob both agree on a prime number **p** and a primitive root of p called **g**.

Alice

- p = 23
- g = 5

Bob

- p = 23
- g = 5

Secret

Attacker