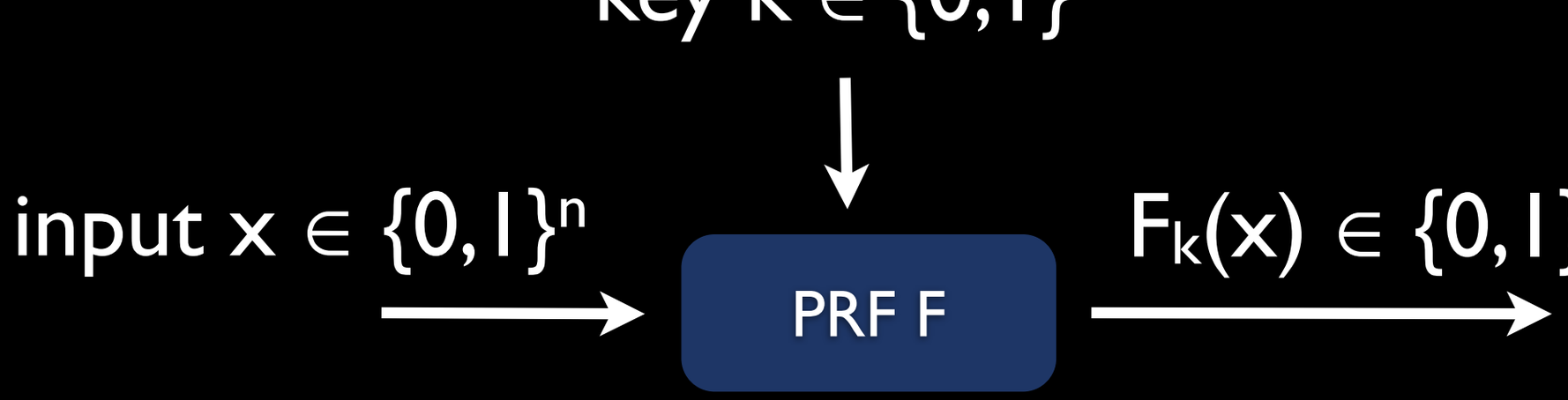
Introduction to Modern Cryptography

4th lecture:

Pseudorandom Functions and Chosen-Plaintext Security

some of these slides are copied from or heavily inspired by the University College London MSc InfoSec 2010 course given by Jens Groth
Thank you very much!

PRG vs PRF

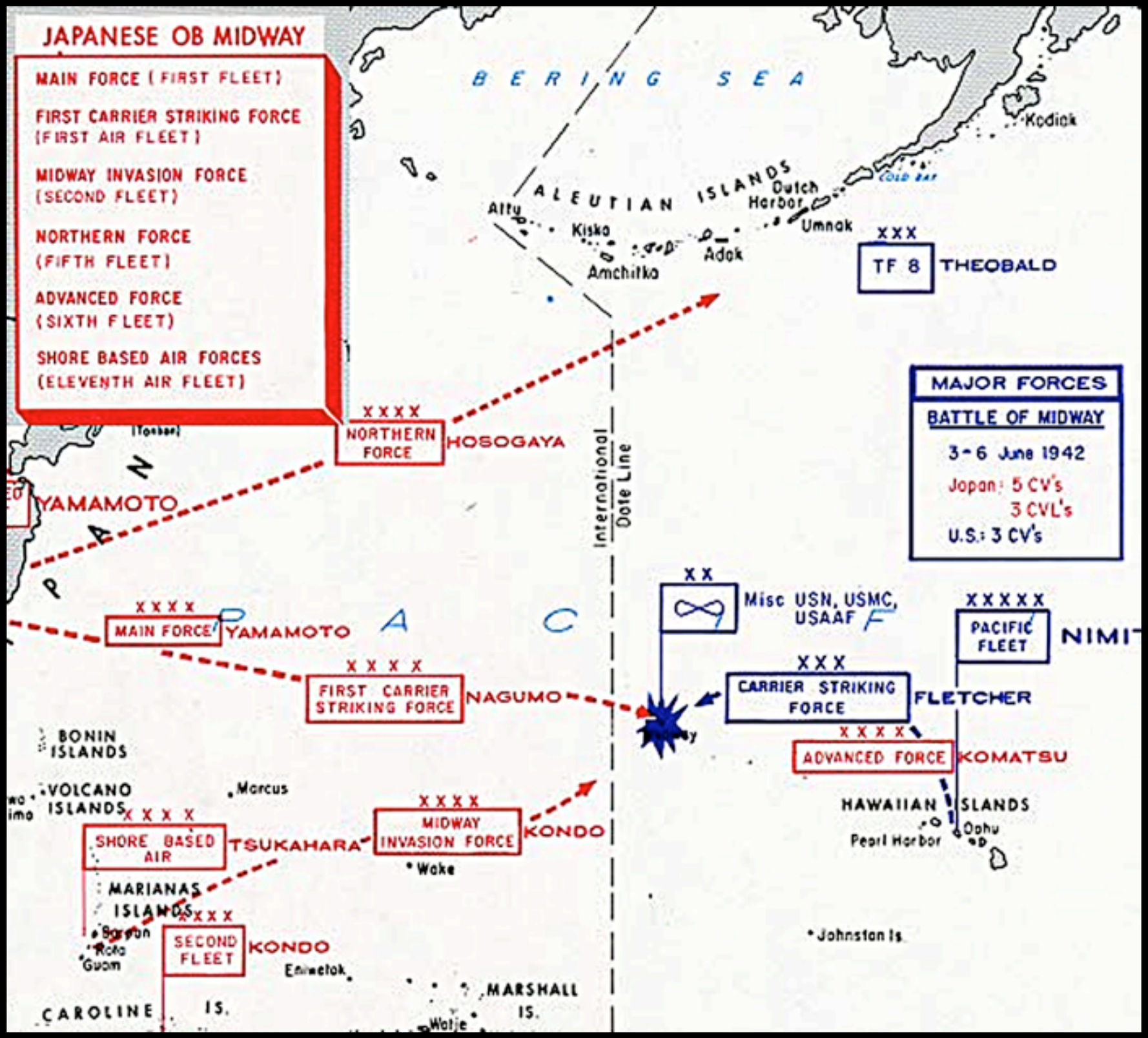


- existence of PRF ⇔ existence of PRG
- both can be based on one-way functions

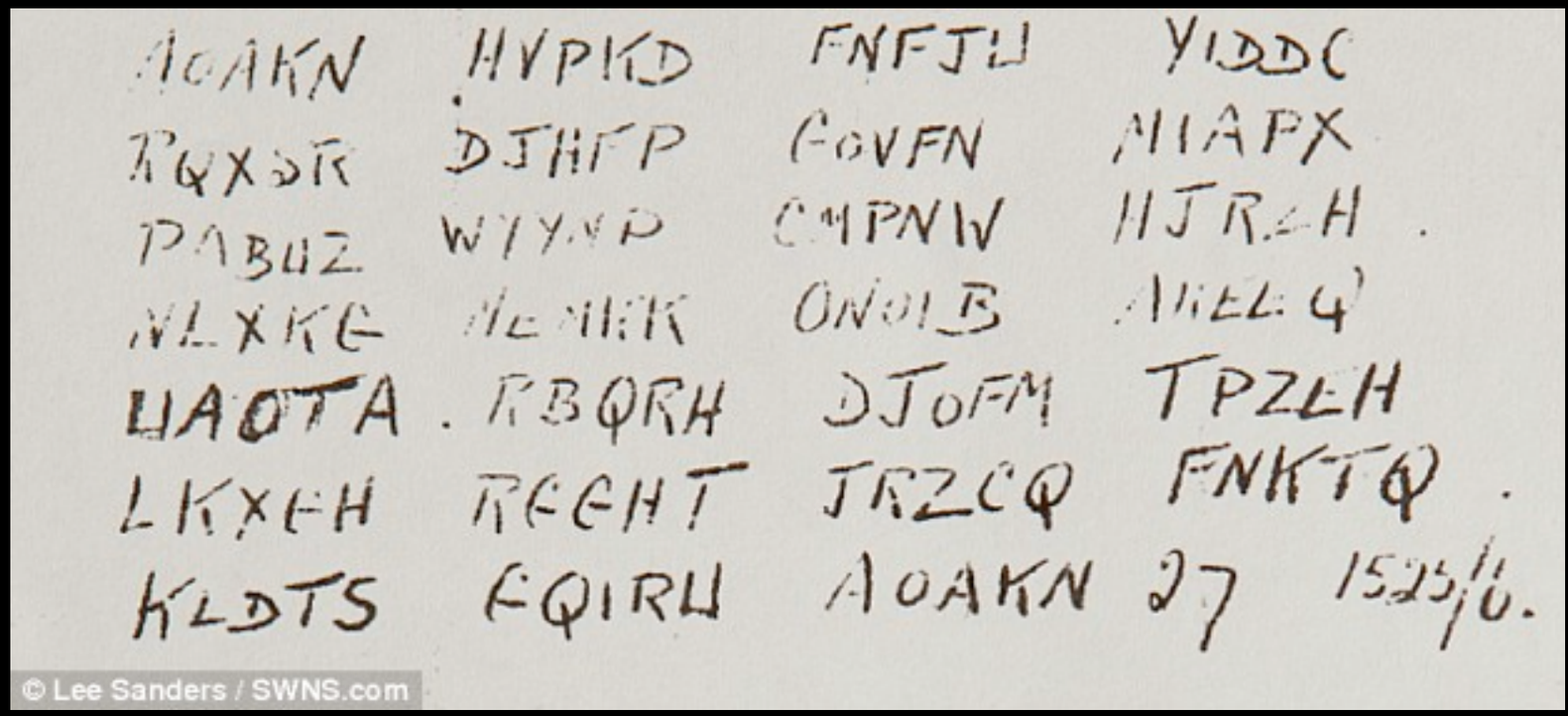
Battle of Midway (1942)

- Midway Atoll: Wikipedia, Google Maps
- important naval battle between the USA and Japan in World War II (Wikipedia)
- decided by cryptographic skills
- US tricked Japanese into acting as encryption oracle
- bottom line: the use of CPA secure encryption could have changed the course of world history

Battle of Midway Map

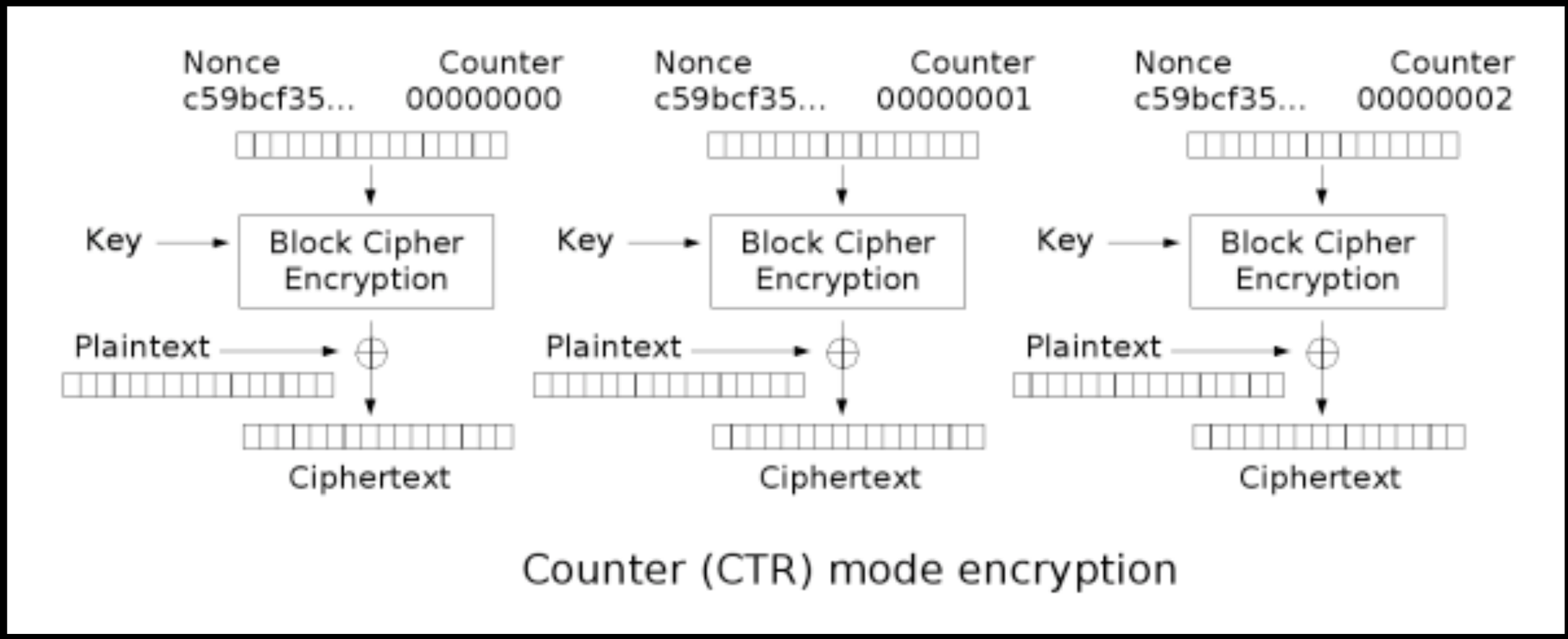


Breaking News (1 Nov 2012)



- another challenge for you to solve
- watch the BBC news story

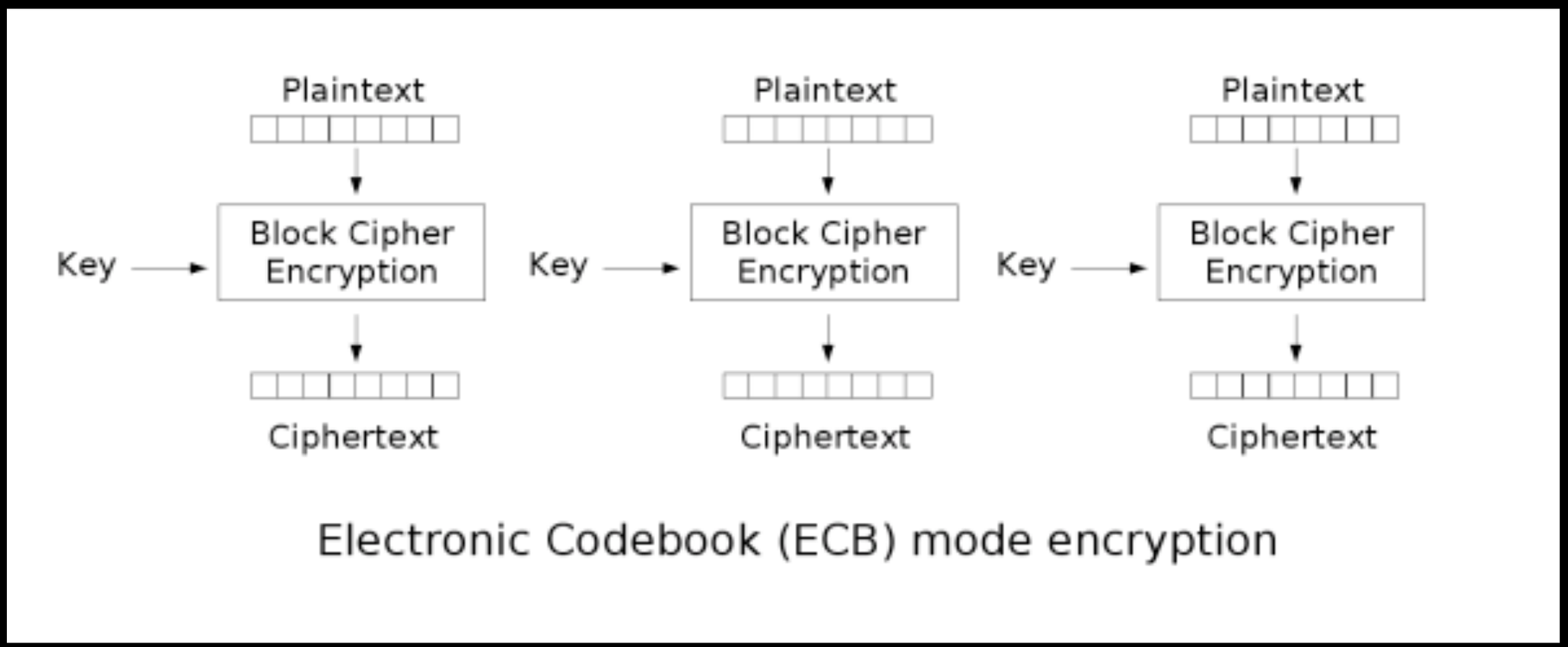
Counter (CTR) mode



Counter (CTR) mode encryption

- CTR mode is CPA-secure if F (the Block Cipher) is a pseudorandom function
- can be precomputed and fully parallelized
- allows random access

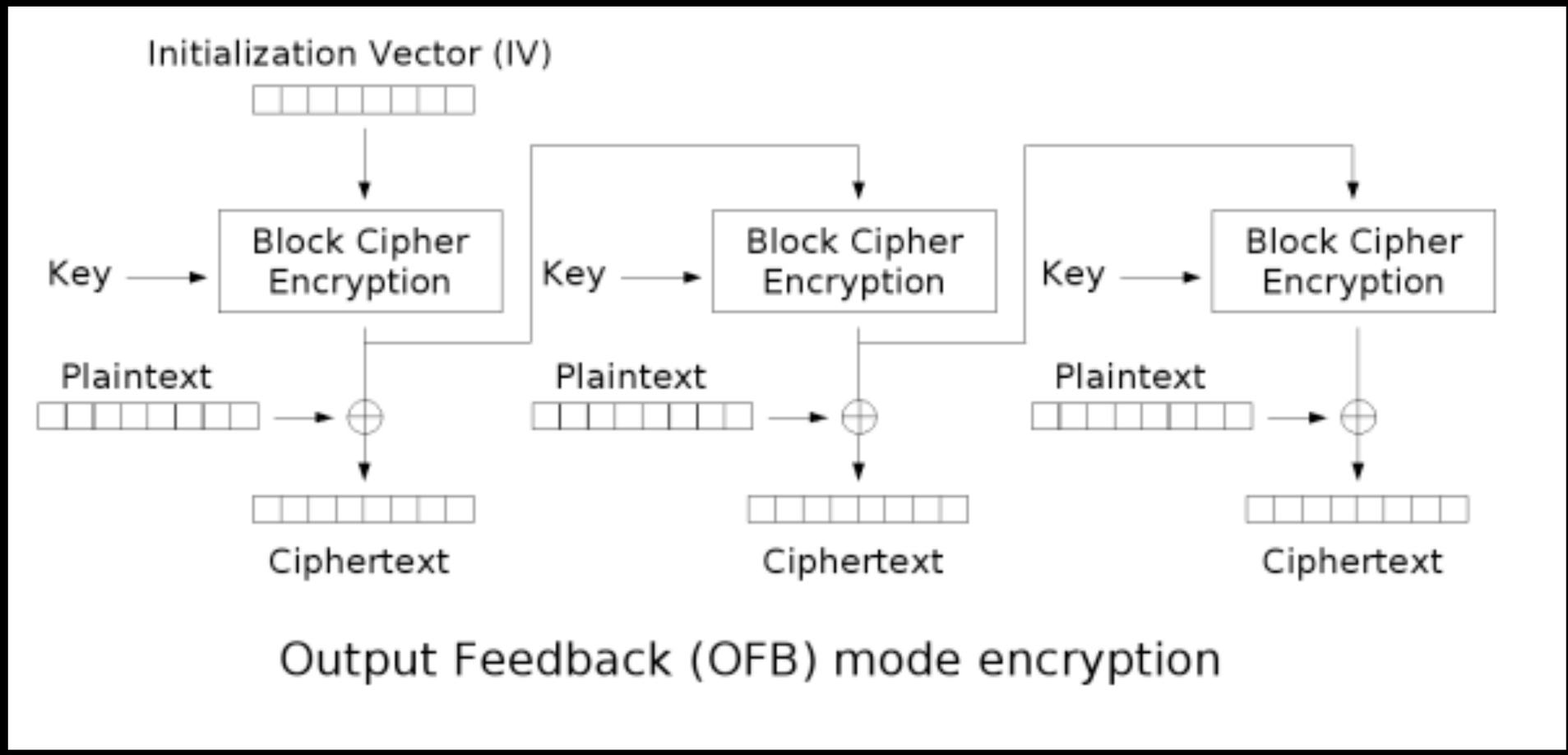
Electronic Code Book (ECB)



Electronic Codebook (ECB) mode encryption

- highly insecure, should never be used
- see example on wikipedia

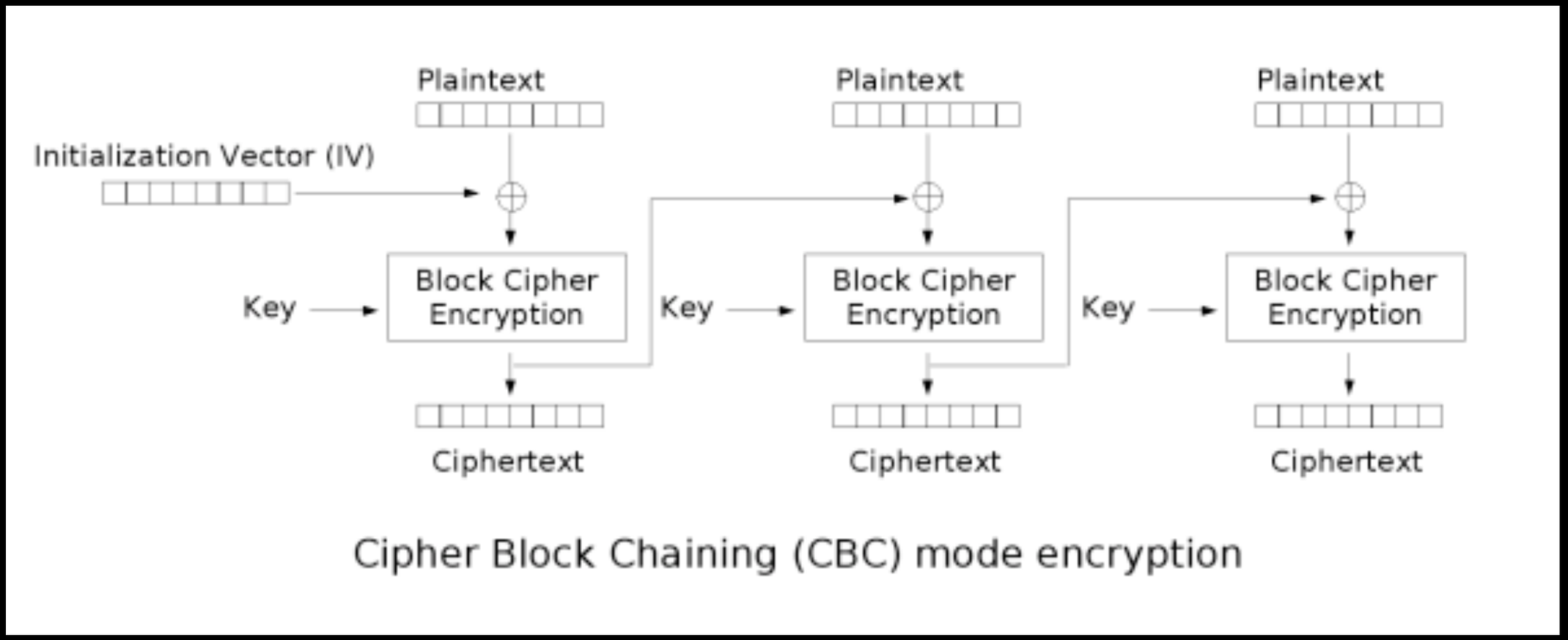
Output Feedback (OFB)



Output Feedback (OFB) mode encryption

- if F is pseudorandom function, then OFB is CPA-secure
- advantage: pseudorandom stream can be precomputed

Cipher Block Chaining (CBC)



Cipher Block Chaining (CBC) mode encryption

- if F is pseudorandom permutation, then CBC is CPA-secure
- drawback: encryption is sequential