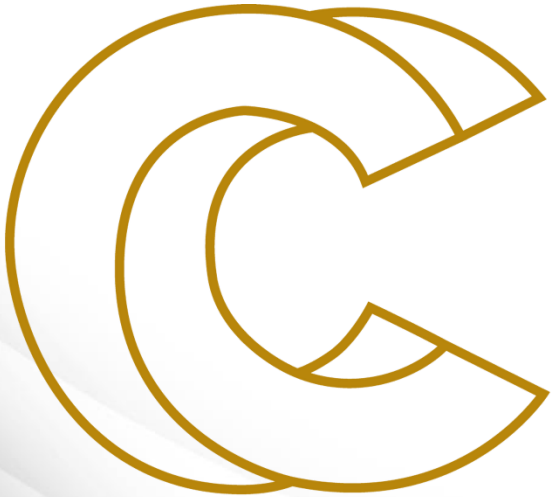

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# GPU Assisted Brute Force Cryptanalysis of GPRS, GSM, RFID, and TETRA

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# Lesson 4: SPECK Block Cipher



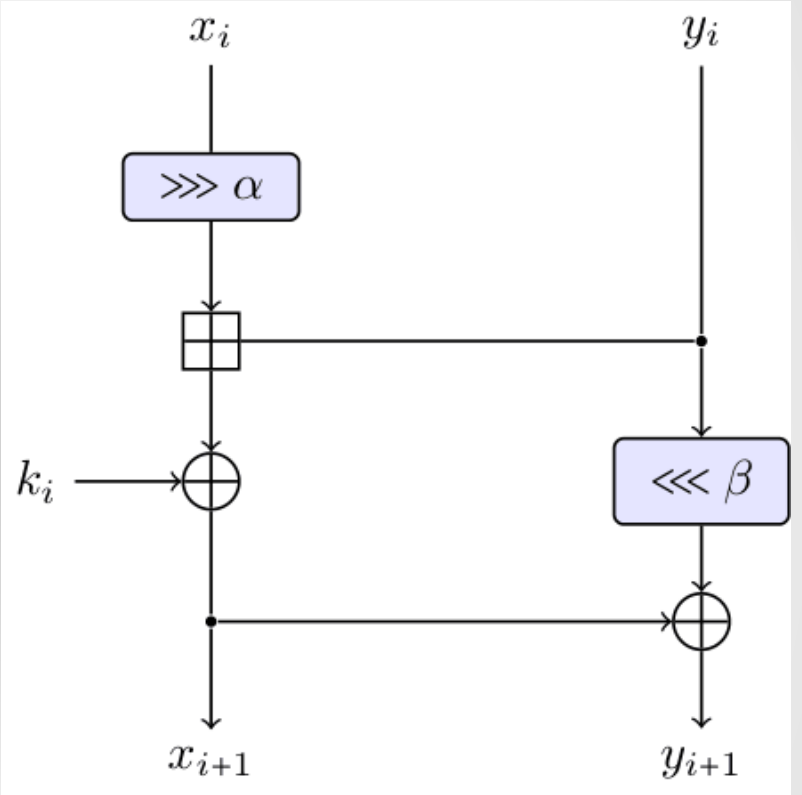
**SPECK Family of Block Ciphers**

- SPECK is a family of add-rotate-xor (ARX) lightweight block ciphers designed in 2013 by National Security Agency (NSA) of United States.
- SPECK supports seven key sizes: 64, 72, 96, 128, 144, 192, and 256 bits.
- Block size and number of rounds depend on the key size and possible variations are provided in the next slide.
- One round of SPECK is shown in the next slide and the key schedule of SPECK also uses this round function.

# Lesson 4: SPECK Block Cipher

## SPECK Family of Block Ciphers

| Block size | Key size | Rounds |
|---|---|---|
| 2x16 = 32 | 4×16 = 64 | 22 |
| 2x24 = 48 | 3×24 = 72 | 22 |
| 2x24 = 48 | 4×24 = 96 | 23 |
| 2x32 = 64 | 3×32 = 96 | 26 |
| 2x32 = 64 | 4×32 = 128 | 27 |
| 2x48 = 96 | 2×48 = 96 | 28 |
| 2x48 = 96 | 3×48 = 144 | 29 |
| 2x64 = 128 | 2×64 = 128 | 32 |
| 2x64 = 128 | 3×64 = 192 | 33 |
| 2x64 = 128 | 4×64 = 256 | 34 |




For the block word size of 16 bits ***alpha = 7*** and ***beta=2***.
For every other block word size ***alpha=8*** and ***beta=3***.

# Lesson 4: SPECK Block Cipher

## SPECK Family of Block Ciphers

- We represent ***k***-bit keyed SPECK with ***r*** rounds as ***SPECK-k-r***.
- In this work we optimized ***SPECK-64-22***, ***SPECK-72-22***, ***SPECK-96-26***, and ***SPECK-128-32*** using the CUDA programming language and our optimizations can easily be modified for other variants of SPECK.
- SPECK became an ISO/IEC RFID air interface standard in 2018 (ISO/IEC 29167-22:2018). This standard was reviewed in 2024 and confirmed.
- Note that the ISO standard contains ***SPECK-96-26***, ***SPECK-96-29***, ***SPECK-128-32***, and ***SPECK-256-34*** versions and without a proper warning of the security implications of using a short key, users may prefer short keys for performance and low hardware footprint.

# Next lecture

**TEA Family of Stream Ciphers**

- How TEA3 stream ciphers work
- How secure they are

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# Thanks!

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