Symmetric Encryption: DES and AES

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- Key-sharing logictics: harder to use
- Smaller key-sizes: 80 bit key is 80 bits of security
- *Much* faster

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Security comes from complexity of the transformation.

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Not secure.

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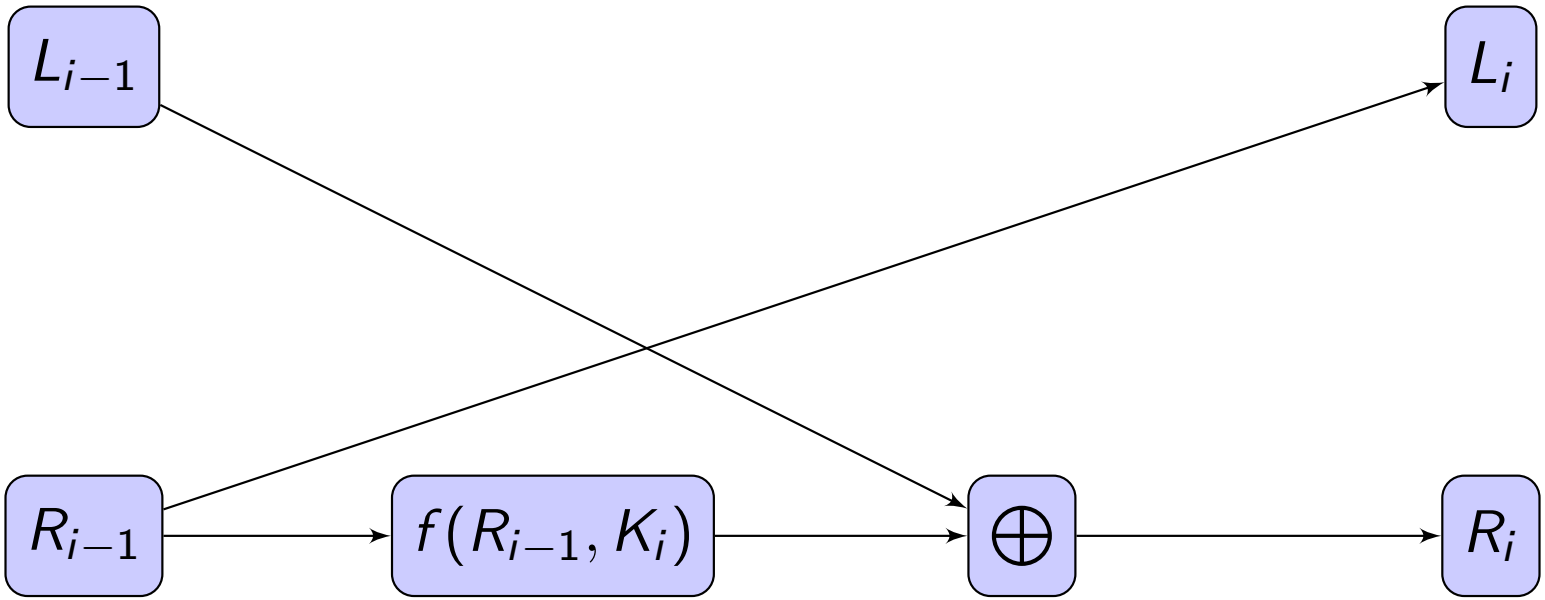
Divide 12-bit block into $L_0 R_0$

For ith round:

- Compute $f(R_{i-1}, K_i)$
- $L_i = R_{i-1}$
- $R_i = L_{i-1} \oplus f(R_{i-1}, K_i)$

Diagram of ith round



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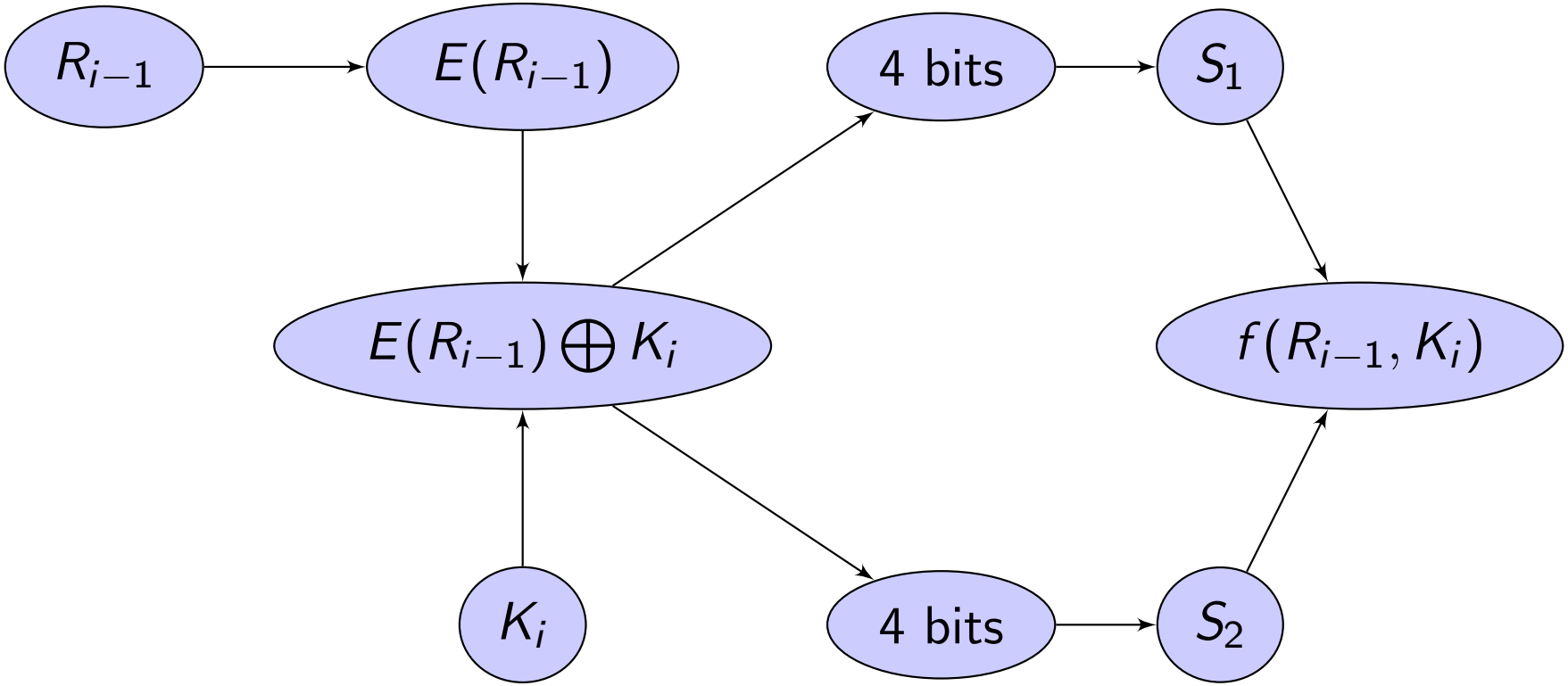
	000	001	010	011	100	101	110	111
0	101	010	001	110	011	100	111	000
1	011	100	110	010	000	111	101	011

Diagram of f



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- Thoroughly broken by 1999. Key broken in 22 hours and 15 minutes.

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- "Feistel structure" combines permutations with S-boxes
- Efficient hardware implementation, but slow in software
- Vulnerable to brute force because of small key size
- Linear cryptanalysis breaks in 2^{43} steps — if you have 2^{43} known plaintexts!

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- Break in 2^{113} steps with 2^{32} known plaintexts

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- 128-bit blocks; 128, 192, or 256 bit key; 10, 12, or 14 rounds
- Matrix operations over a finite field $\mathbb{F}_{2^8}$
- Best known attack: $2^{126.1}$, $2^{189.7}$, or $2^{254.4}$ steps.

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- Use an asymmetric cipher to transmit the key
- Communicate using your fast symmetric cipher