

Padding Oracle Attack Example

For the purpose of the example, let's assume the CPU processes 4 bit words. It will save some typing. That is, all values are represented using 4 bits, and XOR is performed on 4 bit values. Let's assume a block length of 8 words (32 bits).

Suppose the adversary holds ciphertext c_0, c_1 , encrypting the message $m_1 = 1011 \mid 1100 \mid 0010$.

This gets padded to become:

1011 \mid 1100 \mid 0010 \mid 0101 \mid 0101 \mid 0101 \mid 0101 \mid 0101

Padding Oracle Attack Example

For the purpose of the example, let's assume the CPU processes 4 bit words. It will save some typing. That is, all values are represented using 4 bits, and XOR is performed on 4 bit values. Let's assume a block length of 8 words (32 bits).

Suppose the adversary holds ciphertext c_0, c_1 , encrypting the message $m_1 = 1011 \mid 1100 \mid 0010$.

This gets padded to become:

1011 \mid 1100 \mid 0010 \mid 0101 \mid 0101 \mid 0101 \mid 0101 \mid 0101

Step 1 of the attack:

Set $c'_0 = c_0 \oplus (0001 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000)$.

Submit c'_0, c_1 for decryption.

Response comes back "no error".

Padding Oracle Attack Example

For the purpose of the example, let's assume the CPU processes 4 bit words. It will save some typing. That is, all values are represented using 4 bits, and XOR is performed on 4 bit values. Let's assume a block length of 8 words (32 bits).

Suppose the adversary holds ciphertext c_0, c_1 , encrypting the message $m_1 = 1011 \mid 1100 \mid 0010$.

This gets padded to become:

1011 \mid 1100 \mid 0010 \mid 0101 \mid 0101 \mid 0101 \mid 0101 \mid 0101

Step 1 of the attack:

Set $c'_0 = c_0 \oplus (0001 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000)$.

Submit c'_0, c_1 for decryption.

Response comes back "no error".

Set $c'_0 = c_0 \oplus (0000 \mid 0001 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000)$.

Submit c'_0, c_1 for decryption.

Response comes back "no error".

Padding Oracle Attack Example

For the purpose of the example, let's assume the CPU processes 4 bit words. It will save some typing. That is, all values are represented using 4 bits, and XOR is performed on 4 bit values. Let's assume a block length of 8 words (32 bits).

Suppose the adversary holds ciphertext c_0, c_1 , encrypting the message $m_1 = 1011 \mid 1100 \mid 0010$.

This gets padded to become:

1011 \mid 1100 \mid 0010 \mid 0101 \mid 0101 \mid 0101 \mid 0101 \mid 0101

Step 1 of the attack:

Set $c'_0 = c_0 \oplus (0001 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000)$.

Submit c'_0, c_1 for decryption.

Response comes back "no error".

Set $c'_0 = c_0 \oplus (0000 \mid 0001 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000)$.

Submit c'_0, c_1 for decryption.

Response comes back "no error".

Set $c'_0 = c_0 \oplus (0000 \mid 0000 \mid 0001 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000)$.

Submit c'_0, c_1 for decryption.

Response comes back "no error".

Padding Oracle Attack Example

For the purpose of the example, let's assume the CPU processes 4 bit words. It will save some typing. That is, all values are represented using 4 bits, and XOR is performed on 4 bit values. Let's assume a block length of 8 words (32 bits).

Suppose the adversary holds ciphertext c_0, c_1 , encrypting the message $m_1 = 1011 \mid 1100 \mid 0010$.

This gets padded to become:

1011 | 1100 | 0010 | 0101 | 0101 | 0101 | 0101 | 0101

Step 1 of the attack:

Set $c'_0 = c_0 \oplus (0001 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000)$.

Submit c'_0, c_1 for decryption.

Response comes back "no error".

Set $c'_0 = c_0 \oplus (0000 \mid 0001 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000)$.

Submit c'_0, c_1 for decryption.

Response comes back "no error".

Set $c'_0 = c_0 \oplus (0000 \mid 0000 \mid 0001 \mid 0000 \mid 0000 \mid 0000 \mid 0000 \mid 0000)$.

Submit c'_0, c_1 for decryption.

Response comes back "no error".

Set $c'_0 = c_0 \oplus (0000 \mid 0000 \mid 0000 \mid 0001 \mid 0000 \mid 0000 \mid 0000 \mid 0000)$.

Submit c'_0, c_1 for decryption.

Response comes back "error".

Now we know there are 5 bytes of padding in m_1 .

Padding Oracle Attack Example

For the purpose of the example, let's assume the CPU processes 4 bit words. It will save some typing. That is, all values are represented using 4 bits, and XOR is performed on 4 bit values. Let's assume a block length of 8 words (32 bits).

Suppose the adversary holds ciphertext c_0, c_1 , encrypting the message $m_1 = 1011 \mid 1100 \mid 0010$.

This gets padded to become:

1011 \mid 1100 \mid 0010 \mid 0101 \mid 0101 \mid 0101 \mid 0101 \mid 0101

Step 2 of the attack:

What does it take to create 6 bytes of padding?

0110 = 0101 \oplus 0011

Padding Oracle Attack Example

For the purpose of the example, let's assume the CPU processes 4 bit words. It will save some typing. That is, all values are represented using 4 bits, and XOR is performed on 4 bit values. Let's assume a block length of 8 words (32 bits).

Suppose the adversary holds ciphertext c_0, c_1 , encrypting the message $m_1 = 1011 \mid 1100 \mid 0010$.

This gets padded to become:

1011 \mid 1100 \mid 0010 \mid 0101 \mid 0101 \mid 0101 \mid 0101 \mid 0101

Step 2 of the attack:

What does it take to create 6 bytes of padding?

0110 = 0101 \oplus 0011

Set $c'_0 = c_0 \oplus (0000 \mid 0000 \mid 0001 \mid 0011 \mid 0011 \mid 0011 \mid 0011 \mid 0011)$.

$m'_1 = \quad 1011 \mid 1100 \mid 0011 \mid 0110 \mid 0110 \mid 0110 \mid 0110 \mid 0110$

Submit c'_0, c_1 for decryption. Response comes back "error".

Padding Oracle Attack Example

For the purpose of the example, let's assume the CPU processes 4 bit words. It will save some typing. That is, all values are represented using 4 bits, and XOR is performed on 4 bit values. Let's assume a block length of 8 words (32 bits).

Suppose the adversary holds ciphertext c_0, c_1 , encrypting the message $m_1 = 1011 \mid 1100 \mid 0010$.

This gets padded to become:

1011 \mid 1100 \mid 0010 \mid 0101 \mid 0101 \mid 0101 \mid 0101 \mid 0101

Step 2 of the attack:

What does it take to create 6 bytes of padding?

0110 = 0101 \oplus 0011

Set $c'_0 = c_0 \oplus (0000 \mid 0000 \mid 0001 \mid 0011 \mid 0011 \mid 0011 \mid 0011 \mid 0011)$.

$m'_1 = 1011 \mid 1100 \mid 0011 \mid 0110 \mid 0110 \mid 0110 \mid 0110 \mid 0110$

Submit c'_0, c_1 for decryption. Response comes back "error".

Set $c'_0 = c_0 \oplus (0000 \mid 0000 \mid 0010 \mid 0011 \mid 0011 \mid 0011 \mid 0011 \mid 0011)$.

$m'_1 = 1011 \mid 1100 \mid 0000 \mid 0110 \mid 0110 \mid 0110 \mid 0110 \mid 0110$

Submit c'_0, c_1 for decryption. Response comes back "error".

Padding Oracle Attack Example

For the purpose of the example, let's assume the CPU processes 4 bit words. It will save some typing. That is, all values are represented using 4 bits, and XOR is performed on 4 bit values. Let's assume a block length of 8 words (32 bits).

Suppose the adversary holds ciphertext c_0, c_1 , encrypting the message $m_1 = 1011 \mid 1100 \mid 0010$.

This gets padded to become:

1011 \mid 1100 \mid 0010 \mid 0101 \mid 0101 \mid 0101 \mid 0101 \mid 0101

Step 2 of the attack:

What does it take to create 6 bytes of padding?

0110 = 0101 \oplus 0011

Set $c'_0 = c_0 \oplus (0000 \mid 0000 \mid 0001 \mid 0011 \mid 0011 \mid 0011 \mid 0011 \mid 0011)$.

$m'_1 = 1011 \mid 1100 \mid 0011 \mid 0110 \mid 0110 \mid 0110 \mid 0110 \mid 0110$

Submit c'_0, c_1 for decryption. Response comes back "error".

Set $c'_0 = c_0 \oplus (0000 \mid 0000 \mid 0010 \mid 0011 \mid 0011 \mid 0011 \mid 0011 \mid 0011)$.

$m'_1 = 1011 \mid 1100 \mid 0000 \mid 0110 \mid 0110 \mid 0110 \mid 0110 \mid 0110$

Submit c'_0, c_1 for decryption. Response comes back "error".

Set $c'_0 = c_0 \oplus (0000 \mid 0000 \mid 0011 \mid 0011 \mid 0011 \mid 0011 \mid 0011 \mid 0011)$.

$m'_1 = 1011 \mid 1100 \mid 0001 \mid 0110 \mid 0110 \mid 0110 \mid 0110 \mid 0110$

Submit c'_0, c_1 for decryption. Response comes back "error".

Padding Oracle Attack Example

For the purpose of the example, let's assume the CPU processes 4 bit words. It will save some typing. That is, all values are represented using 4 bits, and XOR is performed on 4 bit values. Let's assume a block length of 8 words (32 bits).

Suppose the adversary holds ciphertext c_0, c_1 , encrypting the message $m_1 = 1011 \mid 1100 \mid 0010$.

This gets padded to become:

1011 \mid 1100 \mid 0010 \mid 0101 \mid 0101 \mid 0101 \mid 0101 \mid 0101

Step 2 of the attack:

What does it take to create 6 bytes of padding?

0110 = 0101 \oplus 0011

Set $c'_0 = c_0 \oplus (0000 \mid 0000 \mid 0001 \mid 0011 \mid 0011 \mid 0011 \mid 0011 \mid 0011)$.

$m'_1 = 1011 \mid 1100 \mid 0011 \mid 0110 \mid 0110 \mid 0110 \mid 0110 \mid 0110$

Submit c'_0, c_1 for decryption. Response comes back "error".

Set $c'_0 = c_0 \oplus (0000 \mid 0000 \mid 0010 \mid 0011 \mid 0011 \mid 0011 \mid 0011 \mid 0011)$.

$m'_1 = 1011 \mid 1100 \mid 0000 \mid 0110 \mid 0110 \mid 0110 \mid 0110 \mid 0110$

Submit c'_0, c_1 for decryption. Response comes back "error".

Set $c'_0 = c_0 \oplus (0000 \mid 0000 \mid 0011 \mid 0011 \mid 0011 \mid 0011 \mid 0011 \mid 0011)$.

$m'_1 = 1011 \mid 1100 \mid 0001 \mid 0110 \mid 0110 \mid 0110 \mid 0110 \mid 0110$

Submit c'_0, c_1 for decryption. Response comes back "error".

Set $c'_0 = c_0 \oplus (0000 \mid 0000 \mid 0100 \mid 0011 \mid 0011 \mid 0011 \mid 0011 \mid 0011)$.

$m'_1 = 1011 \mid 1100 \mid 0110 \mid 0110 \mid 0110 \mid 0110 \mid 0110 \mid 0110$

Submit c'_0, c_1 for decryption. Response comes back "no error".

Padding Oracle Attack Example

For the purpose of the example, let's assume the CPU processes 4 bit words. It will save some typing. That is, all values are represented using 4 bits, and XOR is performed on 4 bit values. Let's assume a block length of 8 words (32 bits).

Suppose the adversary holds ciphertext c_0, c_1 , encrypting the message $m_1 = 1011 \mid 1100 \mid 0010$.

This gets padded to become:

1011 \mid 1100 \mid 0010 \mid 0101 \mid 0101 \mid 0101 \mid 0101 \mid 0101

Step 2 of the attack:

What does it take to create 6 bytes of padding?

0110 = 0101 \oplus 0011

Set $c'_0 = c_0 \oplus (0000 \mid 0000 \mid 0100 \mid 0011 \mid 0011 \mid 0011 \mid 0011 \mid 0011)$.

$m'_1 = \quad \quad 1011 \mid 1100 \mid 0110 \mid 0110 \mid 0110 \mid 0110 \mid 0110 \mid 0110$

Submit c'_0, c_1 for decryption. Response comes back "no error".

Padding Oracle Attack Example

For the purpose of the example, let's assume the CPU processes 4 bit words. It will save some typing. That is, all values are represented using 4 bits, and XOR is performed on 4 bit values. Let's assume a block length of 8 words (32 bits).

Suppose the adversary holds ciphertext c_0, c_1 , encrypting the message $m_1 = 1011 \mid 1100 \mid 0010$.

This gets padded to become:

1011 \mid 1100 \mid 0010 \mid 0101 \mid 0101 \mid 0101 \mid 0101 \mid 0101

Step 2 of the attack:

What does it take to create 6 bytes of padding?

0110 = 0101 \oplus 0011

Set $c'_0 = c_0 \oplus (0000 \mid 0000 \mid 0100 \mid 0011 \mid 0011 \mid 0011 \mid 0011 \mid 0011)$.

$m'_1 = \quad \quad \quad 1011 \mid 1100 \mid 0110 \mid 0110 \mid 0110 \mid 0110 \mid 0110 \mid 0110$

Submit c'_0, c_1 for decryption. Response comes back "no error".

We now know that $B \oplus 0100 = 0110$.

Therefore: $B = 0110 \oplus 0100 = 0010$