

CryptoJS



Original documentation:

<https://code.google.com/archive/p/crypto-js/>

Documentation

JavaScript implementations of standard and secure cryptographic algorithms

CryptoJS is a growing collection of standard and secure cryptographic algorithms implemented in JavaScript using best practices and patterns. They are fast, and they have a consistent and simple interface.

If you have a problem with CryptoJS, if you want to discuss new features, or if you want to contribute to the project, you can visit the [CryptoJS discussion group](#).

Hashing

The Hashing Algorithms

MD5

MD5 is a widely used hash function. It's been used in a variety of security applications and is also commonly used to check the integrity of files. Though, MD5 is not collision resistant, and it isn't suitable for applications like SSL certificates or digital signatures that rely on this property.

```
var hash = CryptoJS.MD5("Message");
```

SHA-1

The SHA hash functions were designed by the National Security Agency (NSA). SHA-1 is the most established of the existing SHA hash functions, and it's used in a variety of security applications and

protocols. Though, SHA-1's collision resistance has been weakening as

```
var hash = CryptoJS.SHA1("Message");
```

SHA-2

SHA-256 is one of the four variants in the SHA-2 set. It isn't as widely used as SHA-1, though it appears to provide much better security.

```
var hash = CryptoJS.SHA256("Message");
```

SHA-512 is largely identical to SHA-256 but operates on 64-bit words rather than 32.

```
var hash = CryptoJS.SHA512("Message");
```

CryptoJS also supports SHA-224 and SHA-384, which are largely identical but truncated versions of SHA-256 and SHA-512 respectively.

SHA-3

SHA-3 is the winner of a five-year competition to select a new cryptographic hash algorithm where 64 competing designs were evaluated.

NOTE: I made a mistake when I named this implementation SHA-3. It should be named Keccak[c=2d]. Each of the SHA-3 functions is based on an instance of the Keccak algorithm, which NIST selected as the winner of the SHA-3 competition, but those SHA-3 functions won't produce hashes identical to Keccak.

```
var hash = CryptoJS.SHA3("Message");
```

SHA-3 can be configured to output hash lengths of one of 224, 256, 384, or 512 bits. The default is 512 bits.

```
var hash = CryptoJS.SHA3("Message", { outputLength: 512 });
```

RIPEMD-160

```
var hash = CryptoJS.SHA3("Message", { outputLength: 224 });  
var hash = CryptoJS.RIPEMD160("Message");  
var hash = CryptoJS.SHA3("Message", { outputLength: 256 });
```

```
The Hashing Input CryptoJS.SHA3("Message", { outputLength: 224 });
```

The hash algorithms accept either strings or instances of `CryptoJS.lib.WordArray`. A `WordArray` object represents an array of 32-bit words. When you pass a string, it's automatically converted to a `WordArray` encoded as UTF-8.

The Hashing Output

The hash you get back isn't a string yet. It's a `WordArray` object. When you use a `WordArray` object in a string context, it's automatically converted to a hex string.

```
var hash = CryptoJS.SHA256("Message");  
  
typeof hash  
> "object";  
  
hash  
> "2f77668a9dfbf8d5848b9eeb4a7145ca94c6ed9236e4a773f6dcafa5132b2f91";
```

You can convert a `WordArray` object to other formats by explicitly calling the `toString` method and passing an encoder.

```
var hash = CryptoJS.SHA256("Message");  
  
hash.toString(CryptoJS.enc.Base64)  
> "L3dmip37+NWEi57rSnFFypTG7ZI25Kdz9tyvpRMrL5E=";  
  
hash.toString(CryptoJS.enc.Hex)  
> "2f77668a9dfbf8d5848b9eeb4a7145ca94c6ed9236e4a773f6dcafa5132b2f91";
```

Progressive Hashing

```
var sha256 = CryptoJS.algo.SHA256.create();  
sha256.update("Message Part 1");  
sha256.update("Message Part 2");
```

```
sha256.update("Message Part 3");
```

```
var hash = sha256.finalize();
```

HMAC

Keyed-hash message authentication codes (HMAC) is a mechanism for message authentication using cryptographic hash functions.

HMAC can be used in combination with any iterated cryptographic hash function.

```
var hash = CryptoJS.HmacMD5("Message", "Secret Passphrase");  
var hash = CryptoJS.HmacSHA1("Message", "Secret Passphrase");  
var hash = CryptoJS.HmacSHA256("Message", "Secret Passphrase");  
var hash = CryptoJS.HmacSHA512("Message", "Secret Passphrase");
```

Progressive HMAC Hashing

```
var hmac = CryptoJS.algo.HMAC.create(CryptoJS.algo.SHA256, "Secret Passphrase");  
hmac.update("Message Part 1");  
hmac.update("Message Part 2");  
hmac.update("Message Part 3");  
  
var hash = hmac.finalize();
```

PBKDF2

PBKDF2 is a password-based key derivation function. In many applications of cryptography, user security is ultimately dependent on a password, and because a password usually can't be used directly as a cryptographic key, some processing is required.

A salt provides a large set of keys for any given password, and an iteration count increases the cost of producing keys from a password, thereby also increasing the difficulty of attack.

```
var salt = CryptoJS.lib.WordArray.random(128 / 8);  
var key128Bits = CryptoJS.PBKDF2("Secret Passphrase", salt, {  
    keySize: 128 / 32  
});  
var key256Bits = CryptoJS.PBKDF2("Secret Passphrase", salt, {
```

```

    keySize: 256 / 32
  });
  var key512Bits = CryptoJS.PBKDF2("Secret Passphrase", salt, {
    keySize: 512 / 32
  });
  var key512Bits1000Iterations = CryptoJS.PBKDF2("Secret Passphrase", salt, {
    keySize: 512 / 32,
    iterations: 1000
  });

```

Ciphers

The Cipher Algorithms

AES

The Advanced Encryption Standard (AES) is a U.S. Federal Information Processing Standard (FIPS). It was selected after a 5-year process where 15 competing designs were evaluated.

```

var encrypted = CryptoJS.AES.encrypt("Message", "Secret Passphrase");

var decrypted = CryptoJS.AES.decrypt(encrypted, "Secret Passphrase");

```

CryptoJS supports AES-128, AES-192, and AES-256. It will pick the variant by the size of the key you pass in. If you use a passphrase, then it will generate a 256-bit key.

DES, Triple DES

DES is a previously dominant algorithm for encryption, and was published as an official Federal Information Processing Standard (FIPS). DES is now considered to be insecure due to the small key size.

```

var encrypted = CryptoJS.DES.encrypt("Message", "Secret Passphrase");

var decrypted = CryptoJS.DES.decrypt(encrypted, "Secret Passphrase");

```

Triple DES applies DES three times to each block to increase the key size. The algorithm is believed to be secure in this form.

Rabbit

Rabbit is a high-performance stream cipher and a finalist in the eSTREAM Portfolio. It is one of the four designs selected after a 3 1/2-year process where 22 designs were evaluated.

```
var encrypted = CryptoJS.Rabbit.encrypt("Message", "Secret Passphrase");  
  
var decrypted = CryptoJS.Rabbit.decrypt(encrypted, "Secret Passphrase");
```

RC4, RC4Drop

RC4 is a widely-used stream cipher. It's used in popular protocols such as SSL and WEP. Although remarkable for its simplicity and speed, the algorithm's history doesn't inspire confidence in its security.

```
var encrypted = CryptoJS.RC4.encrypt("Message", "Secret Passphrase");  
  
var decrypted = CryptoJS.RC4.decrypt(encrypted, "Secret Passphrase");
```

It was discovered that the first few bytes of keystream are strongly non-random and leak information about the key. We can defend against this attack by discarding the initial portion of the keystream. This modified algorithm is traditionally called RC4-drop.

By default, 192 words (768 bytes) are dropped, but you can configure the algorithm to drop any number of words.

```
var encrypted = CryptoJS.RC4Drop.encrypt("Message", "Secret Passphrase");  
  
var encrypted = CryptoJS.RC4Drop.encrypt("Message", "Secret Passphrase", {  
    drop: 3072 / 4  
});  
  
var decrypted = CryptoJS.RC4Drop.decrypt(encrypted, "Secret Passphrase", {  
    drop: 3072 / 4  
});
```

Custom Key and IV

```
var key = CryptoJS.enc.Hex.parse("000102030405060708090a0b0c0d0e0f");
```

```
var iv = CryptoJS.enc.Hex.parse("101112131415161718191a1b1c1d1e1f");  
  
var encrypted = CryptoJS.AES.encrypt("Message", key, { iv: iv });
```

Block Modes and Padding

```
var encrypted = CryptoJS.AES.encrypt("Message", "Secret Passphrase", {  
  mode: CryptoJS.mode.CFB,  
  padding: CryptoJS.pad.AnsiX923  
});
```

CryptoJS supports the following modes:

- CBC (the default)
- CFB
- CTR
- OFB
- ECB

And CryptoJS supports the following padding schemes:

- Pkcs7 (the default)
- Iso97971
- AnsiX923
- Iso10126
- ZeroPadding
- NoPadding

The Cipher Input

For the plaintext message, the cipher algorithms accept either strings or instances of `CryptoJS.lib.WordArray`.

For the key, when you pass a string, it's treated as a passphrase and used to derive an actual key and IV. Or you can pass a `WordArray` that represents the actual key. If you pass the actual key, you must also pass the actual IV.

For the ciphertext, the cipher algorithms accept either strings or instances of `CryptoJS.lib.CipherParams`. A `CipherParams` object represents a collection of parameters such as the IV, a salt, and the raw ciphertext itself. When you pass a string, it's automatically converted to a `CipherParams` object according to a configurable format strategy.

The Cipher Output

The plaintext you get back after decryption is a `WordArray` object. See [Hashing's Output](#) for more detail.

The ciphertext you get back after encryption isn't a string yet. It's a `CipherParams` object. A `CipherParams` object gives you access to all the parameters used during encryption. When you use a `CipherParams` object in a string context, it's automatically converted to a string according to a format strategy. The default is an OpenSSL-compatible format.

```
var encrypted = CryptoJS.AES.encrypt("Message", "Secret Passphrase");  
  
encrypted.key  
> "74eb593087a982e2a6f5dded54ecd96d1fd0f3d44a58728cdcd40c55227522223 ";  
  
encrypted.iv  
> "7781157e2629b094f0e3dd48c4d786115";  
  
encrypted.salt  
> "7a25f9132ec6a8b34";  
  
encrypted.ciphertext  
> "73e54154a15d1beeb509d9e12f1e462a0";  
  
encrypted  
> "U2FsdGVkX1+iX5Ey7GqLND5UFUoV0b7rUJ2eEvHkYqA=";
```



You can define your own formats in order to be compatible with other crypto implementations. A format is an object with two methods—`stringify` and `parse`—that converts between `CipherParams` objects and ciphertext strings.

Here's how you might write a JSON formatter:

```
var JsonFormatter = {  
  stringify: function(cipherParams) {  
    // create json object with ciphertext  
    var jsonObj = { ct: cipherParams.ciphertext.toString(CryptoJS.enc.Base64) };  
  }  
};
```



```

// optionally add iv or salt
if (cipherParams.iv) {
    jsonObj.iv = cipherParams.iv.toString();
}

if (cipherParams.salt) {
    jsonObj.s = cipherParams.salt.toString();
}

// stringify json object
return JSON.stringify(jsonObj);
},
parse: function(jsonStr) {
    // parse json string
    var jsonObj = JSON.parse(jsonStr);

    // extract ciphertext from json object, and create cipher params object
    var cipherParams = CryptoJS.lib.CipherParams.create({
        ciphertext: CryptoJS.enc.Base64.parse(jsonObj.ct)
    });

    // optionally extract iv or salt

    if (jsonObj.iv) {
        cipherParams.iv = CryptoJS.enc.Hex.parse(jsonObj.iv);
    }

    if (jsonObj.s) {
        cipherParams.salt = CryptoJS.enc.Hex.parse(jsonObj.s);
    }

    return cipherParams;
}
};

var encrypted = CryptoJS.AES.encrypt("Message", "Secret Passphrase", {
    format: JsonFormatter
});

encrypted
> {
    ct: "tZ4MsEnfbcd0wqau68a0rQ==",
    iv: "8a8c8fd8fe33743d3638737ea4a00698",
    s: "ba06373c8f57179c"
};

```

```

var decrypted = CryptoJS.AES.decrypt(encrypted, "Secret Passphrase", {
  format: JsonFormatter
});

decrypted.toString(CryptoJS.enc.Utf8)

```

Progressive Ciphering

```

var key = CryptoJS.enc.Hex.parse("000102030405060708090a0b0c0d0e0f");
var iv = CryptoJS.enc.Hex.parse("101112131415161718191a1b1c1d1e1f");

// encrypt
var aesEncryptor = CryptoJS.algo.AES.createEncryptor(key, { iv: iv });

var ciphertextPart1 = aesEncryptor.process("Message Part 1");
var ciphertextPart2 = aesEncryptor.process("Message Part 2");
var ciphertextPart3 = aesEncryptor.process("Message Part 3");
var ciphertextPart4 = aesEncryptor.finalize();

// decrypt
var aesDecryptor = CryptoJS.algo.AES.createDecryptor(key, { iv: iv });

var plaintextPart1 = aesDecryptor.process(ciphertextPart1);
var plaintextPart2 = aesDecryptor.process(ciphertextPart2);
var plaintextPart3 = aesDecryptor.process(ciphertextPart3);
var plaintextPart4 = aesDecryptor.process(ciphertextPart4);
var plaintextPart5 = aesDecryptor.finalize();

```

Interoperability

With OpenSSL

Encrypt with OpenSSL:

```
openssl enc -aes-256-cbc -in infile -out outfile -pass pass:"Secret Passphrase"
```

Decrypt with CryptoJS:

```
var decrypted = CryptoJS.AES.decrypt(openSSLEncrypted, "Secret Passphrase");
```

Encoders

CryptoJS can convert from encoding formats such as Base64, Latin1 or Hex to WordArray objects and vice-versa.

```
var words = CryptoJS.enc.Base64.parse("SGVsbG8sIFdvcmxkIQ==");

var base64 = CryptoJS.enc.Base64.stringify(words);

var words = CryptoJS.enc.Latin1.parse("Hello, World!");

var latin1 = CryptoJS.enc.Latin1.stringify(words);

var words = CryptoJS.enc.Hex.parse("48656c6c662c20576f72266421");

var hex = CryptoJS.enc.Hex.stringify(words);

var words = CryptoJS.enc.Utf8.parse(" ");

var utf8 = CryptoJS.enc.Utf8.stringify(words);

var words = CryptoJS.enc.Utf16.parse("Hello, World!");

var utf16 = CryptoJS.enc.Utf16.stringify(words);

var words = CryptoJS.enc.Utf16LE.parse("Hello, World!");

var utf16 = CryptoJS.enc.Utf16LE.stringify(words);
```

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