# MBS Xojo Encryption Kit

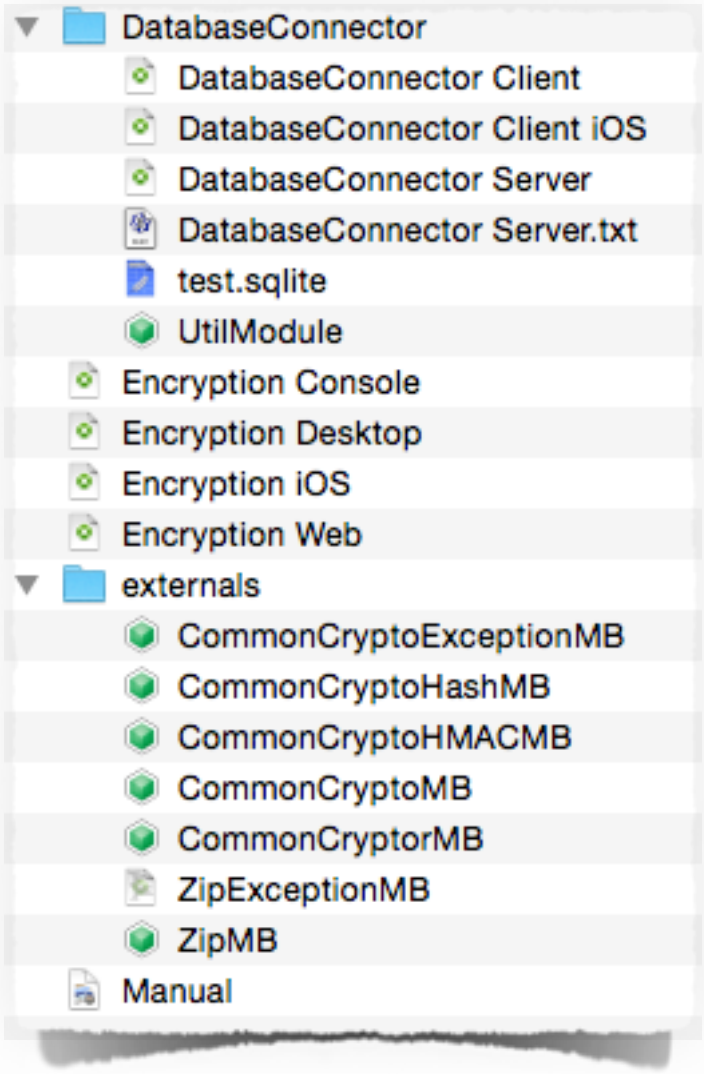
Version 1.1, © 2014-2019 by Christian Schmitz

# About the MBS Xojo Encryption Kit

The MBS Xojo Encryption Kit provides you with a few useful classes and modules to easily add encryption to your Xojo iOS application.

**The Kit contains:**

- Wrapper for OS X and iOS CommonCrypto framework
- Compression/Decompression functions using zlib
- Database Connector for encrypted database queries from iOS to server app



**CommonCrypto**
The Encryption Kit contains a complete wrapper for CommonCrypto, Apple's encryption library on OS X and iOS:

**Features**

- Hashes with various algorithms:
  MD2, MD4, MD5, SHA1, SHA224, SHA384, SHA256 and SHA512
- Key derivation with PBKDF2
- Encryption with AES, Blowfish, DES and others
- Hardware accelerated
- Key wrapping with AES

**Wrapper Features**

- For old and new Xojo framework
- Using exception handling to track error
- Using enums for saver constant passing
- Test code included
- Convenience functions to pass values as text or string instead of MemoryBlocks
- Parameter validation
- All classes with MB postfix to avoid name conflicts.
- Includes EncodeHex function
- Compiles for all targets
- All module definitions are protected to avoid conflicts
- Inline documentation
- Full Source code, no encryption
- Works for 32bit and 64bit targets.
- Projects for Desktop, iOS, Web and Console using our classes.

**Zip**
For our database connector we added compression functions, so we can compress our recordsets for the transmission.

- Zlib wrapper for Compression and Decompression of memory blocks in memory.
- for Win/Linux with MBS Compression Plugin

**Database Connector**

As Xojo for iOS does not support direct database server queries, we provide a sample implementation for a secure connection. Database query is encoded with JSON and sent to server compressed and encrypted. Server will connect to database, run the query, pack the recordset and send it back to client.

**Features Server:**

- Console application for running in background on server
- Reads preferences file for database name, password, user and server port
- Using ServerSocket for taking queries
- Code to Encrypt & Decrypt, Compress & Uncompress messages

**Features Client Desktop:**

- Using Sockets for synchronous queries, 3 attempts
- Classes for RecordSet in memory
- Query window to run queries.

**Features Client iOS:**

- Socket for connecting to server and running queries asynchronously
- Query view to run queries and show result in table.
- Delegate to inform about query finished/failed
- Classes for RecordSet in memory

**Possible future features:**

- Automatic Key exchange instead of shared key.
- Reuse connection
- Logins

# Interfaces

## CommonCryptoExceptionMB

```
Class CommonCryptoExceptionMB Inherits RuntimeException
        Sub Constructor(m as string, e as Integer = 0)
                The exception class if something went wrong with encryption
        Sub Constructor(m as text, e as Integer = 0)
                The exception class if something went wrong with encryption
End Class
```

## CommonCryptoHashMB

```
Class CommonCryptoHashMB
        Sub Constructor(h as CommonCryptoMB.hashes)
        Sub Destructor()
                Explicit Cleanup
        Function Final1() As xojo.Core.MemoryBlock
                Returns final hash
        Function Final2() As MemoryBlock
                Returns final hash
        Function Update(Data as MemoryBlock) As MemoryBlock
                Process some data.

                data    Data to process.

                This can be called multiple times.
        Sub Update(Data as string)
                Process some data.

                data    Data to process.

                This can be called multiple times.
        Sub Update(Data as text)
                Process some data.

                data    Data to process.

                This can be called multiple times.
        Sub Update(Data as xojo.Core.MemoryBlock)
                Process some data.

                data    Data to process.

                This can be called multiple times.
End Class
```

## CommonCryptoHMACMB

```
Class CommonCryptoHMACMB
        Sub Constructor(type as CommonCryptoMB.HMacAlgorithm, key as MemoryBlock)
                Initialize an CCHmacContext with provided raw key bytes.
                algorithm   HMAC algorithm to perform.
                key         Raw key bytes.
        Sub Constructor(type as CommonCryptoMB.HMacAlgorithm, key as string)
                Initialize an CCHmacContext with provided raw key bytes.
                algorithm   HMAC algorithm to perform.
                key         Raw key bytes.
        Sub Constructor(type as CommonCryptoMB.HMacAlgorithm, key as text)
                Initialize an CCHmacContext with provided raw key bytes.
                algorithm   HMAC algorithm to perform.
                key         Raw key bytes.
        Sub Constructor(type as CommonCryptoMB.HMacAlgorithm, key as xojo.Core.MemoryBlock)
                Initialize an CCHmacContext with provided raw key bytes.
                algorithm   HMAC algorithm to perform.
                key         Raw key bytes.
        Sub Destructor()
                Explicit Cleanup
        Function Final1() As xojo.Core.MemoryBlock
                Obtain the final Message Authentication Code.
        Function Final2() As MemoryBlock
                Obtain the final Message Authentication Code.
        Sub Update(Data as MemoryBlock)
                Process some data.

                data        Data to process.

                This can be called multiple times.
        Sub Update(Data as string)
                Process some data.

                data        Data to process.

                This can be called multiple times.
        Sub Update(Data as text)
                Process some data.

                data        Data to process.

                This can be called multiple times.
        Sub Update(Data as xojo.Core.MemoryBlock)
                Process some data.

                data        Data to process.

                This can be called multiple times.
End Class
```

## CommonCryptoMB

```
Module CommonCryptoMB
    Const CC_MD2_DIGEST_LENGTH = 16
    Const CC_MD4_DIGEST_LENGTH = 16
    Const CC_MD5_DIGEST_LENGTH = 16
    Const CC_SHA1_DIGEST_LENGTH = 20
    Const CC_SHA224_DIGEST_LENGTH = 28
    Const CC_SHA256_DIGEST_LENGTH = 32
    Const CC_SHA384_DIGEST_LENGTH = 48
    Const CC_SHA512_DIGEST_LENGTH = 64
    Const kCCAlignmentError = -4303
    Const kCCBufferTooSmall = -4301
    Const kCCDecodeError = -4304
    Const kCCMemoryFailure = -4302
    Const kCCOptionECBMode = 2
    Const kCCOptionPKCS7Padding = 1
    Const kCCOverflow = -4306
    Const kCCParamError = -4300
    Const kCCRNGFailure = -4307
    Const kCCSuccess = 0
    Const kCCUnimplemented = -4305
    Const kLibrary =
    Enum CryptBlockSize
        kCCBlockSizeAES128 = 16
        kCCBlockSizeDES = 8
        kCCBlockSize3DES = 8
        kCCBlockSizeCAST = 8
        kCCBlockSizeRC2 = 8
        kCCBlockSizeBlowfish = 8
    End Enum
    Enum CryptKeySize
        kCCKeySizeAES128 = 16
        kCCKeySizeAES192 = 24
        kCCKeySizeAES256 = 256
        kCCKeySizeDES = 8
        kCCKeySize3DES = 24
        kCCKeySizeMinCAST = 5
        kCCKeySizeMaxCAST = 16
        kCCKeySizeMinRC4 = 1
        kCCKeySizeMaxRC4 = 512
        kCCKeySizeMinRC2 = 1
        kCCKeySizeMaxRC2 = 128
        kCCKeySizeMinBlowfish = 8
        kCCKeySizeMaxBlowfish = 56
    End Enum
    Enum CryptoAlgorithm
        AES128 = 0
        AES = 0
        DES = 1
        ThreeDES = 2
        CAST = 3
        RC4 = 4
        RC2 = 5
        Blowfish = 6
    End Enum
    Enum CryptoMode
        kCCModeECB = 1
        kCCModeCBC = 2
        kCCModeCFB = 3
        kCCModeCTR = 4
        kCCModeF8 = 5
        kCCModeLRW = 6
        kCCModeOFB = 7
        kCCModeXTS = 8
        kCCModeRC4 = 9
```

```
        kCCModeCFB8 = 10
    End Enum
    Enum CryptoOperation
        Encrypt = 0
        Decrypt = 1
    End Enum
    Enum CryptoPadding
        No = 0
        PKCS7 = 1
    End Enum
    Enum HMacAlgorithm
        SHA1 = 0
        MD5 = 1
        SHA256 = 2
        SHA384 = 3
        SHA512 = 4
        SHA224 = 5
    End Enum
    Enum Hashes
        MD2 = 2
        MD4 = 4
        MD5 = 5
        SHA1 = 1
        SHA224 = 224
        SHA384 = 384
        SHA256 = 256
        SHA512 = 512
    End Enum
    Enum PseudoRandomAlgorithm
        SHA1 = 1
        SHA224 = 2
        SHA256 = 3
        SHA384 = 4
        SHA512 = 5
    End Enum
    Enum WrappingAlgorithm
        AES = 1
    End Enum
    Protected Function CalibratePBKDF2(passwordLength as Integer, SaltLength as Integer, algorithm as
PseudoRandomAlgorithm, msec as Integer = 1000) As Integer
        Determine the number of PRF rounds to use for a specific delay on the current platform.

        algorithm      Currently only PBKDF2 is available via kCCPBKDF2
        passwordLen    The length of the text password in bytes.
        saltLen        The length of the salt in bytes.
        prf            The Pseudo Random Algorithm to use for the derivation iterations.
        derivedKeyLen  The expected length of the derived key in bytes.
        msec           The targetted duration we want to achieve for a key derivation with these parameters.

        the number of iterations to use for the desired processing time.
    Protected Function Crypt(Operation as CryptoOperation, Algorithm as CryptoAlgorithm, Options as Integer,
key as MemoryBlock, Data as MemoryBlock, IV as MemoryBlock = nil) As MemoryBlock
    Protected Function Crypt(Operation as CryptoOperation, Algorithm as CryptoAlgorithm, Options as Integer,
key as xojo.core.MemoryBlock, Data as xojo.core.MemoryBlock, IV as xojo.core.MemoryBlock = nil) As xojo.core.MemoryBlock
    Protected Function EncodeHex(data as xojo.Core.MemoryBlock) As text
        encodes MemoryBlock as text
    Protected Function HMAC(HashType as HMacAlgorithm, Key as MemoryBlock, Data as MemoryBlock) As
MemoryBlock
        Stateless, one-shot HMAC function.
        Returns hash as memoryblock
    Protected Function HMAC(HashType as HMacAlgorithm, Key as String, Data as string) As MemoryBlock
        Stateless, one-shot HMAC function.
        Returns hash as memoryblock
    Protected Function HMAC(HashType as HMacAlgorithm, Key as Text, Data as text) As
xojo.Core.MemoryBlock
        Stateless, one-shot HMAC function.
```

Returns hash as memoryblock

**Protected Function** HMAC(HashType **as** HMacAlgorithm, Key **as** Xojo.Core.MemoryBlock, Data **as** xojo.Core.MemoryBlock) **As** xojo.Core.MemoryBlock

Stateless, one-shot HMAC function.

Returns hash as memoryblock

**Protected Function** HMacHashSize(h **as** HMacAlgorithm) **As integer**

size of hash in bytes

**Protected Function** Hash(HashType **as** Hashes, Data **as** MemoryBlock) **As** MemoryBlock

one shot hash function

calculates hash for given data

**Protected Function** Hash(HashType **as** Hashes, Data **as string**) **As** MemoryBlock

one shot hash function

calculates hash for given data

**Protected Function** Hash(HashType **as** Hashes, Data **as** text) **As** xojo.Core.MemoryBlock

one shot hash function

calculates hash for given data

**Protected Function** Hash(HashType **as** Hashes, Data **as** xojo.Core.MemoryBlock) **As** xojo.Core.MemoryBlock

one shot hash function

calculates hash for given data

**Protected Function** KeyDerivationPBKDF2(password **as** MemoryBlock, salt **as** MemoryBlock, algorithm **as** PseudoRandomAlgorithm, rounds **as Integer**) **As** MemoryBlock

Derive a key from a text password/passphrase

algorithm Currently only PBKDF2 is available via kCCPBKDF2

password The text password used as input to the derivation function. The actual octets present in this string will be used with no additional processing. It's extremely important that the same encoding and normalization be used each time this routine is called if the same key is expected to be derived.

salt The salt byte values used as input to the derivation function.

prf The Pseudo Random Algorithm to use for the derivation iterations.

rounds The number of rounds of the Pseudo Random Algorithm to use.

The following values are used to designate the PRF:

* PseudoRandomAlgorithm.SHA1
* PseudoRandomAlgorithm.SHA224
* PseudoRandomAlgorithm.SHA256
* PseudoRandomAlgorithm.SHA384
* PseudoRandomAlgorithm.SHA512

Raises exception with Parameter error in case of bad values for the password, salt, and unwrapped key pointers as well as a bad value for the prf function.

PS: Maybe before putting password or salt here, push them through hash function first?

**Protected Function** KeyDerivationPBKDF2(password **as** xojo.core.MemoryBlock, salt **as** xojo.core.MemoryBlock, algorithm **as** PseudoRandomAlgorithm, rounds **as Integer**) **As** xojo.core.MemoryBlock

Derive a key from a text password/passphrase

algorithm Currently only PBKDF2 is available via kCCPBKDF2

password The text password used as input to the derivation function. The actual octets present in this string will be used with no additional processing. It's extremely important that the same encoding and normalization be used each time this routine is called if the same key is expected to be derived.

salt The salt byte values used as input to the derivation function.

prf The Pseudo Random Algorithm to use for the derivation iterations.

rounds The number of rounds of the Pseudo Random Algorithm to use.

The following values are used to designate the PRF:

* PseudoRandomAlgorithm.SHA1
* PseudoRandomAlgorithm.SHA224
* PseudoRandomAlgorithm.SHA256
* PseudoRandomAlgorithm.SHA384
* PseudoRandomAlgorithm.SHA512

Raises exception with Parameter error in case of bad values for the password, salt, and unwrapped key pointers as well as a bad value for the prf function.

PS: Maybe before putting password or salt here, push them through hash function first?

**Protected Function** SymmetricKeyUnwrap(algorithm **as** WrappingAlgorithm, IV **as** MemoryBlock, kek **as** MemoryBlock, wrappedKey **as** MemoryBlock) **As** MemoryBlock

Unwrap a symmetric key with a Key Encryption Key (KEK).

algorithm Currently only AES Keywrapping (rfc3394) is available via WrappingAlgorithm.AES
iv The initialization value to be used. rfc3394_iv1 is available as a constant for the standard IV to use.
kek The Key Encryption Key to be used to unwrap the raw key.
wrappedKey The wrapped key bytes.

The algorithm chosen is determined by the algorithm parameter and the size of the key being wrapped (ie aes128 for 128 bit keys).

May raise CommonCryptoExceptionMB with BufferTooSmall indicates insufficent space in the rawKey buffer.

ParamError can result from bad values for the kek, rawKey, and wrappedKey key pointers.

**Protected Function** SymmetricKeyUnwrap(algorithm **as** WrappingAlgorithm, IV **as** xojo.Core.MemoryBlock, kek **as** xojo.Core.MemoryBlock, wrappedKey **as** xojo.core.MemoryBlock) **As** xojo.core.MemoryBlock

Unwrap a symmetric key with a Key Encryption Key (KEK).

algorithm Currently only AES Keywrapping (rfc3394) is available via WrappingAlgorithm.AES
iv The initialization value to be used. rfc3394_iv1 is available as a constant for the standard IV to use.
kek The Key Encryption Key to be used to unwrap the raw key.
wrappedKey The wrapped key bytes.

The algorithm chosen is determined by the algorithm parameter and the size of the key being wrapped (ie aes128 for 128 bit keys).

May raise CommonCryptoExceptionMB with BufferTooSmall indicates insufficent space in the rawKey buffer.

ParamError can result from bad values for the kek, rawKey, and wrappedKey key pointers.

**Protected Function** SymmetricKeyWrap(algorithm **as** WrappingAlgorithm, IV **as** MemoryBlock, kek **as** MemoryBlock, rawKey **as** MemoryBlock) **As** MemoryBlock

Wrap a symmetric key with a Key Encryption Key (KEK).

algorithm Currently only AES Keywrapping (rfc3394) is available via WrappingAlgorithm.AES
iv The initialization value to be used. rfc3394iv1 is available as a constant for the standard IV to use.
kek The Key Encryption Key to be used to wrap the raw key.
rawKey The raw key bytes to be wrapped.

Returns the wrapped key as memoryblock.

Can raise CommonCryptoExceptionMB with BufferTooSmall indicates insufficent space in the wrappedKey buffer.

ParamError can result from bad values for the kek, rawKey, and wrappedKey key pointers.

**Protected Function** SymmetricKeyWrap(algorithm **as** WrappingAlgorithm, IV **as** xojo.Core.MemoryBlock, kek **as** xojo.Core.MemoryBlock, rawKey **as** xojo.core.MemoryBlock) **As** xojo.core.MemoryBlock

Wrap a symmetric key with a Key Encryption Key (KEK).

algorithm Currently only AES Keywrapping (rfc3394) is available via WrappingAlgorithm.AES
iv The initialization value to be used. rfc3394iv1 is available as a constant for the standard IV to use.
kek The Key Encryption Key to be used to wrap the raw key.
rawKey The raw key bytes to be wrapped.

Returns the wrapped key as memoryblock.

Can raise CommonCryptoExceptionMB with BufferTooSmall indicates insufficent space in the wrappedKey buffer.

ParamError can result from bad values for the kek, rawKey, and wrappedKey key pointers.

**Protected Sub** TestRandom()

test random function

**Protected Sub** checkResult(e **as** **Int32**)

```
                raises exception in case something went wrong
        Protected Function generateBytes1(count as integer) As xojo.core.MemoryBlock
                Return random bytes in a buffer allocated by the caller.
                The PRNG returns cryptographically strong random bits suitable for use as cryptographic keys, IVs,
nonces etc.
                count   Number of random bytes to return.
                Returns MemoryBlock with data or raises exception
                available in Mac OS X 10.10 or iOS 8.0
        Protected Function generateBytes2(count as integer) As MemoryBlock
                Return random bytes in a buffer allocated by the caller.
                The PRNG returns cryptographically strong random bits suitable for use as cryptographic keys, IVs,
nonces etc.
                count   Number of random bytes to return.
                Returns MemoryBlock with data or raises exception
                available in Mac OS X 10.10 or iOS 8.0
        Protected Function rfc3394iv1() As xojo.Core.MemoryBlock
                returns RFC 3394 Initial Vector
        Protected Function rfc3394iv2() As MemoryBlock
                returns RFC 3394 Initial Vector
        Protected Sub test()
        Protected Sub testCrypt()
                test encryption
        Protected Sub testHMAC()
                test hmac functions
        Protected Sub testHash()
                test hash functions
        Protected Sub testKeyGen()
                test key derivation
        Protected Sub testKeyWrap()
        Note "Info"
                This is a complete wrapper for CommonCrypto, Apple's encryption library on OS X and iOS

                Features

                * Hashes with various algorithms
                * Key derivation with PBKDF2
                * Encryption with AES, Blowfish, DES and others
                * Hardware accelerated
                * Key wrapping with AES

                Wrapper Features

                * For old and new framework
                * using exception handling to track error
                * using enums for saver constant passing
                * test code included
                * convenience functions to pass values as text or string instead of MemoryBlocks
                * parameter validation
                * all classes with MB postfix to avoid conflicts
                * EncodeHex function
                * Compiles for all targets
                * All module definitions are protected to avoid conflicts
                * Inline documentation
                * Full Source code, no encryption
        Note "License"
                todo
End Module
```

## CommonCryptorMB

```
Class CommonCryptorMB
    Sub Constructor(Operation as CommonCryptoMB.CryptoOperation, Algorithm as
CommonCryptoMB.CryptoAlgorithm, Options as Integer, key as MemoryBlock, iv as MemoryBlock = nil)
        Create a cryptographic context.

        op      Defines the basic operation: Encrypt or Decrypt.
        alg     Defines the algorithm.
        options   A word of flags defining options. can be 0, kCCOptionPKCS7Padding and/or
kCCOptionECBMode.
        key     Raw key material. Must be appropriate in length for the selected operation and algorithm.
Some algorithms  provide for varying key lengths.
        iv      Initialization vector, optional. Used by block ciphers when Cipher Block Chaining (CBC)
mode is enabled. If present, must be the same length as the selected algorithm's block size.
        If CBC mode is selected (by the absence of the kCCOptionECBMode bit in the options flags) and no
        IV is present, a NULL (all zeroes) IV will be used.
        This parameter is ignored if ECB mode is used or if a stream cipher algorithm is selected.
    Sub Constructor(Operation as CommonCryptoMB.CryptoOperation, Algorithm as
CommonCryptoMB.CryptoAlgorithm, Options as Integer, key as Xojo.Core.MemoryBlock, iv as xojo.core.MemoryBlock = nil)
        Create a cryptographic context.

        op      Defines the basic operation: Encrypt or Decrypt.
        alg     Defines the algorithm.
        options   A word of flags defining options. can be 0, kCCOptionPKCS7Padding and/or
kCCOptionECBMode.
        key     Raw key material. Must be appropriate in length for the selected operation and algorithm.
Some algorithms  provide for varying key lengths.
        iv      Initialization vector, optional. Used by block ciphers when Cipher Block Chaining (CBC)
mode is enabled. If present, must be the same length as the selected algorithm's block size.
        If CBC mode is selected (by the absence of the kCCOptionECBMode bit in the options flags) and no
        IV is present, a NULL (all zeroes) IV will be used.
        This parameter is ignored if ECB mode is used or if a stream cipher algorithm is selected.
    Sub Constructor(Operation as CommonCryptoMB.CryptoOperation, Algorithm as
CommonCryptoMB.CryptoAlgorithm, Options as Integer, key as string, iv as MemoryBlock = nil)
        Create a cryptographic context.

        op      Defines the basic operation: Encrypt or Decrypt.
        alg     Defines the algorithm.
        options   A word of flags defining options. can be 0, kCCOptionPKCS7Padding and/or
kCCOptionECBMode.
        key     Raw key material. Must be appropriate in length for the selected operation and algorithm.
Some algorithms  provide for varying key lengths.
        iv      Initialization vector, optional. Used by block ciphers when Cipher Block Chaining (CBC)
mode is enabled. If present, must be the same length as the selected algorithm's block size.
        If CBC mode is selected (by the absence of the kCCOptionECBMode bit in the options flags) and no
        IV is present, a NULL (all zeroes) IV will be used.
        This parameter is ignored if ECB mode is used or if a stream cipher algorithm is selected.
    Sub Constructor(Operation as CommonCryptoMB.CryptoOperation, Algorithm as
CommonCryptoMB.CryptoAlgorithm, Options as Integer, key as text, iv as xojo.core.MemoryBlock = nil)
        Create a cryptographic context.

        op      Defines the basic operation: Encrypt or Decrypt.
        alg     Defines the algorithm.
        options   A word of flags defining options. can be 0, kCCOptionPKCS7Padding and/or
kCCOptionECBMode.
        key     Raw key material. Must be appropriate in length for the selected operation and algorithm.
Some algorithms  provide for varying key lengths.
        iv      Initialization vector, optional. Used by block ciphers when Cipher Block Chaining (CBC)
mode is enabled. If present, must be the same length as the selected algorithm's block size.
        If CBC mode is selected (by the absence of the kCCOptionECBMode bit in the options flags) and no
        IV is present, a NULL (all zeroes) IV will be used.
        This parameter is ignored if ECB mode is used or if a stream cipher algorithm is selected.
    Sub Constructor(Operation as CommonCryptoMB.CryptoOperation, Mode as CommonCryptoMB.CryptoMode,
Algorithm as CommonCryptoMB.CryptoAlgorithm, Padding as CommonCryptoMB.CryptoPadding, key as MemoryBlock, Tweak
as Memoryblock = nil, iv as MemoryBlock = nil, NumRounds as Integer = 0, Options as Integer = 0)
```

```
		Create a cryptographic context.
	Sub Constructor(Operation as CommonCryptoMB.CryptoOperation, Mode as CommonCryptoMB.CryptoMode, Algorithm as CommonCryptoMB.CryptoAlgorithm, Padding as CommonCryptoMB.CryptoPadding, key as Xojo.Core.MemoryBlock, Tweak as xojo.core.Memoryblock = nil, iv as xojo.core.MemoryBlock = nil, NumRounds as Integer = 0, Options as Integer = 0)
		Create a cryptographic context.
	Sub Constructor(Operation as CommonCryptoMB.CryptoOperation, Mode as CommonCryptoMB.CryptoMode, Algorithm as CommonCryptoMB.CryptoAlgorithm, Padding as CommonCryptoMB.CryptoPadding, key as string, Tweak as Memoryblock = nil, iv as MemoryBlock = nil, NumRounds as Integer = 0, Options as Integer = 0)
		Create a cryptographic context.
	Sub Constructor(Operation as CommonCryptoMB.CryptoOperation, Mode as CommonCryptoMB.CryptoMode, Algorithm as CommonCryptoMB.CryptoAlgorithm, Padding as CommonCryptoMB.CryptoPadding, key as text, Tweak as xojo.core.Memoryblock = nil, iv as xojo.core.MemoryBlock = nil, NumRounds as Integer = 0, Options as Integer = 0)
		Create a cryptographic context.
	Sub Destructor()
		Cleanup
	Function Final1() As xojo.Core.MemoryBlock
		Finish an encrypt or decrypt operation, and obtain the (possible)
		final data output.

		Returns final bytes of the encrypted/decrypted data. This can be empty memoryblock.

		Raises exceptions on error. kCCBufferTooSmall indicates insufficent space in the dataOut buffer.
		kCCAlignmentError When decrypting, or when encrypting with a block cipher with padding disabled,
		kCCAlignmentError will be returned if the total number of bytes provided to Update is
		not an integral multiple of the current algorithm's block size.
		kCCDecodeError  Indicates garbled ciphertext or the wrong key during decryption. This can only
		be returned while decrypting with padding enabled.

		Except when kCCBufferTooSmall is returned, the Cryptor
		can no longer be used for subsequent operations unless
		Reset() is called on it.

		It is not necessary to call Final() when performing
		symmetric encryption or decryption if padding is disabled, or
		when using a stream cipher.

		It is not necessary to call Final() when aborting an operation.
	Function Final2() As MemoryBlock
		Finish an encrypt or decrypt operation, and obtain the (possible)
		final data output.

		Returns final bytes of the encrypted/decrypted data. This can be empty memoryblock.

		Raises exceptions on error. kCCBufferTooSmall indicates insufficent space in the dataOut buffer.
		kCCAlignmentError When decrypting, or when encrypting with a block cipher with padding disabled,
		kCCAlignmentError will be returned if the total number of bytes provided to Update is
		not an integral multiple of the current algorithm's block size.
		kCCDecodeError  Indicates garbled ciphertext or the wrong key during decryption. This can only
		be returned while decrypting with padding enabled.

		Except when kCCBufferTooSmall is returned, the Cryptor
		can no longer be used for subsequent operations unless
		Reset() is called on it.

		It is not necessary to call Final() when performing
		symmetric encryption or decryption if padding is disabled, or
		when using a stream cipher.

		It is not necessary to call Final() when aborting an operation.
	Sub Reset(iv as MemoryBlock)
		Reinitializes an existing CCCryptorRef with a (possibly)
		new initialization vector. Not implemented for stream ciphers.

		iv          Optional initialization vector; if present, must
		be the same size as the current algorithm's block size.
```

```
        The the only possible errors are kCCParamError and kCCUnimplemented which cause exceptions.

        This can be called on a cryptor with data pending (i.e.
        in a padded mode operation before Final is called);
        however any pending data will be lost in that case.
    Sub Reset(iv as xojo.core.memoryblock = nil)
        Reinitializes an existing CCCryptorRef with a (possibly)
        new initialization vector. Not implemented for stream ciphers.

        iv          Optional initialization vector; if present, must
        be the same size as the current algorithm's block size.

        The the only possible errors are kCCParamError and kCCUnimplemented which cause exceptions.

        This can be called on a cryptor with data pending (i.e.
        in a padded mode operation before Final is called);
        however any pending data will be lost in that case.
    Function Update(Data as MemoryBlock) As MemoryBlock
        Process (encrypt, decrypt) some data. The result, if any, is returned as memoryblock.

        data:       Data to process.

        Returns data. The result memoryblock can be smaller or bigger due to alignment.

        Can raise error. kCCBufferTooSmall indicates insufficent space in the dataOut buffer.

        This routine can be called multiple times. The caller does not need to align input data lengths to block
sizes; input is

        bufferred as necessary for block ciphers.

        When performing symmetric encryption with block ciphers,
        and padding is enabled via kCCOptionPKCS7Padding, the total
        number of bytes provided by all the calls to this function
        when encrypting can be arbitrary (i.e., the total number
        of bytes does not have to be block aligned). However if
        padding is disabled, or when decrypting, the total number
        of bytes does have to be aligned to the block size; otherwise
        Final() will return kCCAlignmentError.

        Generally, when all data has been processed, call Final().

        In the following cases, the CCCryptorFinal() is superfluous as
        it will not yield any data nor return an error:
        1. Encrypting or decrypting with a block cipher with padding
          disabled, when the total amount of data provided to
          Update() is an integral multiple of the block size.
        2. Encrypting or decrypting with a stream cipher.
    Function Update(Data as string) As MemoryBlock
        Process (encrypt, decrypt) some data. The result, if any, is returned as memoryblock.

        data:       Data to process.

        Returns data. The result memoryblock can be smaller or bigger due to alignment.

        Can raise error. kCCBufferTooSmall indicates insufficent space in the dataOut buffer.

        This routine can be called multiple times. The caller does not need to align input data lengths to block
sizes; input is

        bufferred as necessary for block ciphers.

        When performing symmetric encryption with block ciphers,
        and padding is enabled via kCCOptionPKCS7Padding, the total
        number of bytes provided by all the calls to this function
        when encrypting can be arbitrary (i.e., the total number
        of bytes does not have to be block aligned). However if
```

```
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        of bytes does have to be aligned to the block size; otherwise
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        it will not yield any data nor return an error:
        1. Encrypting or decrypting with a block cipher with padding
           disabled, when the total amount of data provided to
           Update() is an integral multiple of the block size.
        2. Encrypting or decrypting with a stream cipher.
Function Update(Data as text) As xojo.Core.MemoryBlock
        Process (encrypt, decrypt) some data. The result, if any, is returned as memoryblock.

        data:       Data to process.

        Returns data. The result memoryblock can be smaller or bigger due to alignment.

        Can raise error. kCCBufferTooSmall indicates insufficent space in the dataOut buffer.

        This routine can be called multiple times. The caller does not need to align input data lengths to block
sizes; input is

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        it will not yield any data nor return an error:
        1. Encrypting or decrypting with a block cipher with padding
           disabled, when the total amount of data provided to
           Update() is an integral multiple of the block size.
        2. Encrypting or decrypting with a stream cipher.
Function Update(Data as xojo.Core.MemoryBlock) As xojo.Core.MemoryBlock
        Process (encrypt, decrypt) some data. The result, if any, is returned as memoryblock.

        data:       Data to process.

        Returns data. The result memoryblock can be smaller or bigger due to alignment.

        Can raise error. kCCBufferTooSmall indicates insufficent space in the dataOut buffer.

        This routine can be called multiple times. The caller does not need to align input data lengths to block
sizes; input is

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        when encrypting can be arbitrary (i.e., the total number
        of bytes does not have to be block aligned). However if
        padding is disabled, or when decrypting, the total number
        of bytes does have to be aligned to the block size; otherwise
        Final() will return kCCAlignmentError.

        Generally, when all data has been processed, call Final().
```

```
        In the following cases, the CCCryptorFinal() is superfluous as
        it will not yield any data nor return an error:
        1. Encrypting or decrypting with a block cipher with padding
          disabled, when the total amount of data provided to
          Update() is an integral multiple of the block size.
        2. Encrypting or decrypting with a stream cipher.
    Note "About"
        Generic interface for symmetric encryption.

        This interface provides access to a number of symmetric encryption
        algorithms. Symmetric encryption algorithms come in two "flavors" -  block
        ciphers, and stream ciphers. Block ciphers process data (while both
        encrypting and decrypting) in discrete chunks of  data called blocks;
        stream ciphers operate on arbitrary sized data.

        The object declared in this interface, CCCryptor, provides access to both
        block ciphers and stream ciphers with the same API; however some options
        are available for block ciphers that do not apply to stream ciphers.

        The general operation of a CCCryptor is: initialize it with raw key data
        and other optional fields with Constructor; process input data via one or
        more calls to Update(), each of which may result in output data being
        returned as memoryblock; and obtain possible remaining output data with
        Final functions. The CCCryptor is disposed of via destructor, or it can be
        reused (with the same key data as provided to Constructor()) by calling
        Reset().

        One option for block ciphers is padding, as defined in PKCS7; when padding
        is enabled, the total amount of data encrypted does not have to be an even
        multiple of the block size, and the actual length of plaintext is
        calculated during decryption.

        Another option for block ciphers is Cipher Block Chaining, known as CBC
        mode. When using CBC mode, an Initialization Vector (IV) is provided along
        with the key when starting an encrypt or decrypt operation. If CBC mode is
        selected and no IV is provided, an IV of all zeroes will be used.

        CCCryptor also implements block bufferring, so that individual calls to
        Update() do not have to provide data whose length is aligned to the block
        size. (If padding is disabled, encrypting with block ciphers does require
        that the *total* length of data input to Update() call(s) be aligned to the
        block size.)

        A given CCCryptor can only be used by one thread at a time; multiple
        threads can use safely different CCCryptors at the same time.
    Property Algorithm As CommonCryptoMB.CryptoAlgorithm
    Property Operation As CommonCryptoMB.CryptoOperation
    Property Options As Integer
    Property Padding As CommonCryptoMB.CryptoPadding
End Class
```

## ZipMB

```
Module ZipMB
    Const kEndOfStream = 1
    Const kErrorBuffer = -5
    Const kErrorData = -3
    Const kErrorOK = 0
    Const kErrorOutOfMemory = -4
    Const kLibrary =
    Protected Function Compress(Data as MemoryBlock) As MemoryBlock
        Compresses the source buffer into the destination buffer.

        As you see we always use best compression and calculate buffer size with compressBound

        compress returns kErrorOK if success, kErrorOutOfMemory if there was not
        enough memory, kErrorBuffer if there was not enough room in the output
        buffer. (should never happen)
    Protected Function Compress(t as string) As MemoryBlock
        convert string in current encoding to MemoryBlock
    Protected Function Compress(t as text) As xojo.Core.MemoryBlock
    Protected Function Compress(Data as xojo.Core.MemoryBlock) As xojo.Core.MemoryBlock
        Compresses the source buffer into the destination buffer.

        As you see we always use best compression and calculate buffer size with compressBound

        compress returns kErrorOK if success, kErrorOutOfMemory if there was not
        enough memory, kErrorBuffer if there was not enough room in the output
        buffer. (should never happen)
    Protected Function Decompress(Data as MemoryBlock) As string
        decompress data and return new MemoryBlock
    Protected Function Decompress(Data as xojo.Core.MemoryBlock) As xojo.Core.MemoryBlock
        decompress data and return new MemoryBlock
    Protected Sub test()
End Module
```

## ZipExceptionMB

```
Class ZipExceptionMB Inherits RuntimeException
    Sub Constructor(m as string, e as Integer = 0)
        The exception class if something went wrong with encryption
    Sub Constructor(m as text, e as Integer = 0)
        The exception class if something went wrong with encryption
End Class
```

# AES with 28 rounds

AES can work with 14 rounds (default) or 28 rounds (better).

```
// test encryption with AES 28 rounds

dim HelloWorldText   as text = "Hello World, this is just a test."
dim HelloWorldXCMem  as xojo.Core.MemoryBlock = _
        xojo.core.TextEncoding.UTF8.ConvertTextToData(HelloWorldText)

dim KeyText   as text = "secret"
dim KeyXCMem  as xojo.Core.MemoryBlock
        KeyXCMem = CommonCryptoMB.Hash(CommonCryptoMB.Hashes.MD5, KeyText)

// Operation as CommonCryptoMB.CryptoOperation, Mode as CommonCryptoMB.CryptoMode,
// Algorithm as CommonCryptoMB.CryptoAlgorithm, Padding as CommonCryptoMB.CryptoPadding,
// key as Xojo.Core.MemoryBlock, Tweak as xojo.core.Memoryblock = nil, iv as xojo.core.MemoryBlock = nil,
// NumRounds as Integer = 0, Options as Integer = 0

dim tweak  as xojo.Core.MemoryBlock
dim iv  as xojo.Core.MemoryBlock
dim c as new CommonCryptorMB(CommonCryptoMB.CryptoOperation.Encrypt, _
        CommonCryptoMB.CryptoMode.kCCModeECB, _
        CommonCryptoMB.CryptoAlgorithm.AES, _
        CommonCryptoMB.CryptoPadding.PKCS7, _
        KeyXCMem, _
        tweak, _
        iv, _
        28, 0)

dim m as new xojo.Core.MutableMemoryBlock(0)

m.Append c.Update(HelloWorldXCMem)
m.Append c.Final1

Break
```

# Example for AES CBC

```
// AES 256-bit CBC test code

system.DebugLog "Testing started..."

dim MyVal as text = "If you can read this text then process of encryption and decryption is working well."
dim mbMyVal as xojo.Core.MemoryBlock = xojo.core.TextEncoding.utf8.ConvertTextToData(MyVal)

dim MyPwd as text = "Passphrase goes here"
dim mbMyPwd as xojo.Core.MemoryBlock =
CommonCryptoMB.Hash(CommonCryptoMB.Hashes.SHA256,MyPwd)

System.DebugLog "Test value and passphrase created."

dim iv as xojo.Core.MemoryBlock
dim cryptor as new CommonCryptorMB(CommonCryptoMB.CryptoOperation.Encrypt,
CommonCryptoMB.CryptoMode.kCCModeCBC, _
CommonCryptoMB.CryptoAlgorithm.AES, CommonCryptoMB.CryptoPadding.PKCS7, mbMyPwd, iv)

dim enData1 as xojo.Core.MemoryBlock = Cryptor.Update(mbMyVal)
dim enData2 as xojo.Core.MemoryBlock = cryptor.Final1
dim enData as new xojo.Core.MutableMemoryBlock(enData1)
enData.Append enData2

System.DebugLog "Encrypted data value created."

System.DebugLog "Encrypted data: '" + CommonCryptoMB.EncodeHex(enData) + "'"

dim decryptor as new CommonCryptorMB(CommonCryptoMB.CryptoOperation.Decrypt,
CommonCryptoMB.CryptoMode.kCCModeCBC, _
CommonCryptoMB.CryptoAlgorithm.AES, CommonCryptoMB.CryptoPadding.PKCS7, mbMyPwd, iv)

dim result1 as xojo.Core.MemoryBlock = Cryptor.Update(enData)
dim result2 as xojo.Core.MemoryBlock = cryptor.Final1
dim result as new xojo.Core.MutableMemoryBlock(result1)
result.Append result2

System.DebugLog "Result: '" + xojo.core.TextEncoding.UTF8.ConvertDataToText(result) + "'"
```

# Version History

Tip: If you want to update your existing code with new release, you'd best compare projects with Arbed (http://www.tempel.org/Arbed) and copy modifications to your project.

1.1, 31st July 2019

- DatabaseConnector Server now has a switch in UtilModule to decide if you want to use SQLiteDatabase or MBS SQL Plugin.
- DatabaseConnector Server defaults now on OS X to not use plugin for encryption.
- Added EncodeBase64 and DecodeBase64
- Added AES example.
- Updated for Xojo 2019r1

1.0, first release

# Installation

To get your projects working with this Encryption Kit, you need to follow a few steps.

Drop the folder „externals“ into your project and access all the common crypto or zip modules and classes. Or copy from existing example projects what you need.

# Requirements

You need Xojo 2015r1 or newer.
We did not test with older versions, but you can if you need.

The encryption parts for desktop can use MBS Plugins to perform similar operations on Mac OS X, Windows and Linux.

The SQL connection used in the DatabaseConnector uses MBS Xojo SQL Plugin to connect to database.

# License

Summary:
- You may use Encryption Kit only with one licensed Xojo installation.
- You agree not to share the Encryption Kit or use someone else's Encryption Kit copy.

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