

## NAME

Digest - Modules that calculate message digests

## SYNOPSIS

```
$md5 = Digest->new("MD5");
$sha1 = Digest->new("SHA-1");
$sha256 = Digest->new("SHA-256");
$sha384 = Digest->new("SHA-384");
$sha512 = Digest->new("SHA-512");

$ hmac = Digest->HMAC_MD5($key);
```

## DESCRIPTION

The `Digest::` modules calculate digests, also called "fingerprints" or "hashes", of some data, called a message. The digest is (usually) some small/fixed size string. The actual size of the digest depend of the algorithm used. The message is simply a sequence of arbitrary bytes or bits.

An important property of the digest algorithms is that the digest is *likely* to change if the message change in some way. Another property is that digest functions are one-way functions, i.e. it should be *hard* to find a message that correspond to some given digest. Algorithms differ in how "likely" and how "hard", as well as how efficient they are to compute.

All `Digest::` modules provide the same programming interface. A functional interface for simple use, as well as an object oriented interface that can handle messages of arbitrary length and which can read files directly.

The digest can be delivered in three formats:

### *binary*

This is the most compact form, but it is not well suited for printing or embedding in places that can't handle arbitrary data.

### *hex*

A twice as long string of lowercase hexadecimal digits.

### *base64*

A string of portable printable characters. This is the base64 encoded representation of the digest with any trailing padding removed. The string will be about 30% longer than the binary version. *MIME::Base64* tells you more about this encoding.

The functional interface is simply importable functions with the same name as the algorithm. The functions take the message as argument and return the digest. Example:

```
use Digest::MD5 qw(md5);
$digest = md5($message);
```

There are also versions of the functions with `"_hex"` or `"_base64"` appended to the name, which returns the digest in the indicated form.

## OO INTERFACE

The following methods are available for all `Digest::` modules:

```
$ctx = Digest->XXX($arg,...)
$ctx = Digest->new(XXX => $arg,...)
$ctx = Digest::XXX->new($arg,...)
```

The constructor returns some object that encapsulate the state of the message-digest algorithm. You can add data to the object and finally ask for the digest. The "XXX" should of course be replaced by the proper name of the digest algorithm you want to use.

The two first forms are simply syntactic sugar which automatically load the right module on first use. The second form allow you to use algorithm names which contains letters which are not legal perl identifiers, e.g. "SHA-1". If no implementation for the given algorithm can be found, then an exception is raised.

If `new()` is called as an instance method (i.e. `$ctx->new`) it will just reset the state the object to the state of a newly created object. No new object is created in this case, and the return value is the reference to the object (i.e. `$ctx`).

`$other_ctx = $ctx->clone`

The clone method creates a copy of the digest state object and returns a reference to the copy.

`$ctx->reset`

This is just an alias for `$ctx->new`.

`$ctx->add( $data, ... )`

The `$data` provided as argument are appended to the message we calculate the digest for. The return value is the `$ctx` object itself.

`$ctx->addfile( $io_handle )`

The `$io_handle` is read until EOF and the content is appended to the message we calculate the digest for. The return value is the `$ctx` object itself.

`$ctx->add_bits( $data, $nbits )`

`$ctx->add_bits( $bitstring )`

The bits provided are appended to the message we calculate the digest for. The return value is the `$ctx` object itself.

The two argument form of `add_bits()` will add the first `$nbits` bits from `data`. For the last potentially partial byte only the high order `$nbits % 8` bits are used. If `$nbits` is greater than `length($data) * 8`, then this method would do the same as `$ctx->add($data)`, i.e. `$nbits` is silently ignored.

The one argument form of `add_bits()` takes a `$bitstring` of "1" and "0" chars as argument. It's a shorthand for `$ctx->add_bits(pack("B*", $bitstring), length($bitstring))`.

This example shows two calls that should have the same effect:

```
$ctx->add_bits("111100001010");
$ctx->add_bits("\xF0\xA0", 12);
```

Most digest algorithms are byte based. For those it is not possible to add bits that are not a multiple of 8, and the `add_bits()` method will croak if you try.

`$ctx->digest`

Return the binary digest for the message.

Note that the `digest` operation is effectively a destructive, read-once operation. Once it has been performed, the `$ctx` object is automatically `reset` and can be used to calculate another digest value. Call `$ctx->clone->digest` if you want to calculate the digest without resetting the digest state.

`$ctx->hexdigest`

Same as `$ctx->digest`, but will return the digest in hexadecimal form.

`$ctx->b64digest`

Same as `$ctx->digest`, but will return the digest as a base64 encoded string.

## Digest speed

This table should give some indication on the relative speed of different algorithms. It is sorted by throughput based on a benchmark done with of some implementations of this API:

Algorithm	Size	Implementation	MB/s
MD4	128	Digest::MD4 v1.3	165.0
MD5	128	Digest::MD5 v2.33	98.8
SHA-256	256	Digest::SHA2 v1.1.0	66.7
SHA-1	160	Digest::SHA v4.3.1	58.9
SHA-1	160	Digest::SHA1 v2.10	48.8
SHA-256	256	Digest::SHA v4.3.1	41.3
Haval-256	256	Digest::Haval256 v1.0.4	39.8
SHA-384	384	Digest::SHA2 v1.1.0	19.6
SHA-512	512	Digest::SHA2 v1.1.0	19.3
SHA-384	384	Digest::SHA v4.3.1	19.2
SHA-512	512	Digest::SHA v4.3.1	19.2
Whirlpool	512	Digest::Whirlpool v1.0.2	13.0
MD2	128	Digest::MD2 v2.03	9.5
Adler-32	32	Digest::Adler32 v0.03	1.3
CRC-16	16	Digest::CRC v0.05	1.1
CRC-32	32	Digest::CRC v0.05	1.1
MD5	128	Digest::Perl::MD5 v1.5	1.0
CRC-CCITT	16	Digest::CRC v0.05	0.8

These numbers was achieved Apr 2004 with ActivePerl-5.8.3 running under Linux on a P4 2.8 GHz CPU. The last 5 entries differ by being pure perl implementations of the algorithms, which explains why they are so slow.

## SEE ALSO

*Digest::Adler32*, *Digest::CRC*, *Digest::Haval256*, *Digest::HMAC*, *Digest::MD2*, *Digest::MD4*, *Digest::MD5*, *Digest::SHA*, *Digest::SHA1*, *Digest::SHA2*, *Digest::Whirlpool*

New digest implementations should consider subclassing from *Digest::base*.

*MIME::Base64*

## AUTHOR

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The `Digest::` interface is based on the interface originally developed by Neil Winton for his `MD5` module.

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