

**NAME**

BN\_mod\_mul\_montgomery, BN\_MONT\_CTX\_new, BN\_MONT\_CTX\_free, BN\_MONT\_CTX\_set, BN\_MONT\_CTX\_copy, BN\_from\_montgomery, BN\_to\_montgomery - Montgomery multiplication

**SYNOPSIS**

```
#include <openssl/bn.h>
```

```
BN_MONT_CTX *BN_MONT_CTX_new(void);
```

```
void BN_MONT_CTX_free(BN_MONT_CTX *mont);
```

```
int BN_MONT_CTX_set(BN_MONT_CTX *mont, const BIGNUM *m, BN_CTX *ctx);
```

```
BN_MONT_CTX *BN_MONT_CTX_copy(BN_MONT_CTX *to, BN_MONT_CTX *from);
```

```
int BN_mod_mul_montgomery(BIGNUM *r, BIGNUM *a, BIGNUM *b,
                          BN_MONT_CTX *mont, BN_CTX *ctx);
```

```
int BN_from_montgomery(BIGNUM *r, BIGNUM *a, BN_MONT_CTX *mont,
                       BN_CTX *ctx);
```

```
int BN_to_montgomery(BIGNUM *r, BIGNUM *a, BN_MONT_CTX *mont,
                     BN_CTX *ctx);
```

**DESCRIPTION**

These functions implement Montgomery multiplication. They are used automatically when **BN\_mod\_exp(3)** is called with suitable input, but they may be useful when several operations are to be performed using the same modulus.

**BN\_MONT\_CTX\_new()** allocates and initializes a **BN\_MONT\_CTX** structure.

**BN\_MONT\_CTX\_set()** sets up the *mont* structure from the modulus *m* by precomputing its inverse and a value *R*.

**BN\_MONT\_CTX\_copy()** copies the **BN\_MONT\_CTX** *from* to *to*.

**BN\_MONT\_CTX\_free()** frees the components of the **BN\_MONT\_CTX**, and, if it was created by **BN\_MONT\_CTX\_new()**, also the structure itself. If **mont** is NULL, nothing is done.

**BN\_mod\_mul\_montgomery()** computes  $\text{Mont}(a,b) := a * b * R^{-1}$  and places the result in *r*.

**BN\_from\_montgomery()** performs the Montgomery reduction  $r = a * R^{-1}$ .

**BN\_to\_montgomery()** computes  $\text{Mont}(a, R^2)$ , i.e.  $a \cdot R$ . Note that  $a$  must be nonnegative and smaller than the modulus.

For all functions, *ctx* is a previously allocated **BN\_CTX** used for temporary variables.

## RETURN VALUES

**BN\_MONT\_CTX\_new()** returns the newly allocated **BN\_MONT\_CTX**, and NULL on error.

**BN\_MONT\_CTX\_free()** has no return value.

For the other functions, 1 is returned for success, 0 on error. The error codes can be obtained by **ERR\_get\_error(3)**.

## WARNINGS

The inputs must be reduced modulo **m**, otherwise the result will be outside the expected range.

## SEE ALSO

**ERR\_get\_error(3)**, **BN\_add(3)**, **BN\_CTX\_new(3)**

## HISTORY

**BN\_MONT\_CTX\_init()** was removed in OpenSSL 1.1.0

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