NAME

BN_mod_mul_montgomery, BN_MONT_CTX_new, BN_MONT_CTX_init, 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_init(BN_MONT_CTX *ctx);
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_init()* initializes an existing uninitialized **BN_MONT_CTX**.

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.

BN_mod_mul_montgomery() computes Mont(*a*,*b*):=*a***b**Rˆ-1 and places the result in *r*.

BN_from_montgomery() performs the Montgomery reduction $r = a$*Rˆ-1.

BN_to_montgomery() computes Mont(*a*,Rˆ2), i.e. *a**R. Note that*a* m ust be non-negative and smaller than the modulus.

For all functions, *ctx* is a previously allocated **BN_CTX** used for temporary variables.

The **BN_MONT_CTX** structure is defined as follows:

```
typedef struct bn_mont_ctx_st
{
int ri; /* number of bits in R */
BIGNUM RR; /* R2 (used to convert to Montgomery form) */
BIGNUM N; /* The modulus */
BIGNUM Ni; /* R*(1/R mod N) - N*Ni = 1
* (Ni is only stored for bignum algorithm) */
BN_ULONG n0; /* least significant word of Ni */
int flags;
} BN_MONT_CTX;
```

BN_to_montgomery() is a macro.

RETURN VALUES

BN_MONT_CTX_new() returns the newly allocated **BN_MONT_CTX**, and NULL on error.

BN_MONT_CTX_init() and *BN_MONT_CTX_free()* have no return values.

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

WARNING

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

SEE ALSO

bn(3), *ERR_get_error(3)*, *BN_add(3)*, *BN_CTX_new(3)*

HISTORY

BN_MONT_CTX_new(), *BN_MONT_CTX_free()*, *BN_MONT_CTX_set()*, *BN_mod_mul_montgomery()*, *BN_from_montgomery()* and *BN_to_montgomery()* are available in all versions of SSLeay and OpenSSL.

BN_MONT_CTX_init() and *BN_MONT_CTX_copy()* were added in SSLeay 0.9.1b.