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Red Hat Enterprise Linux Release 9.2 Manual Pages on 'EC_GROUP_new.3ossl' command

\$ man EC_GROUP_new.3ossl

EC_GROUP_NEW(3ossl) OpenSSL EC_GROUP_NEW(3ossl)

NAME

EC_GROUP_get_ecparameters, EC_GROUP_get_ecpkparameters,
EC_GROUP_new_from_params, EC_GROUP_new_from_ecparameters,
EC_GROUP_new_from_ecpkparameters, EC_GROUP_new, EC_GROUP_free,
EC_GROUP_clear_free, EC_GROUP_new_curve_GFp, EC_GROUP_new_curve_GF2m,
EC_GROUP_new_by_curve_name_ex, EC_GROUP_new_by_curve_name,
EC_GROUP_set_curve, EC_GROUP_get_curve, EC_GROUP_set_curve_GFp,
EC_GROUP_get_curve_GFp, EC_GROUP_set_curve_GF2m,
EC_GROUP_get_curve_GF2m, EC_get_builtin_curves, OSSL_EC_curve_nid2name
- Functions for creating and destroying EC_GROUP objects

SYNOPSIS

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

EC_GROUP *EC_GROUP_new_from_params(const OSSL_PARAM params[],
                                   OSSL_LIB_CTX *libctx, const char *propq);

EC_GROUP *EC_GROUP_new_from_ecparameters(const ECPARAMETERS *params);
EC_GROUP *EC_GROUP_new_from_ecpkparameters(const ECPKPARAMETERS *params);
void EC_GROUP_free(EC_GROUP *group);

EC_GROUP *EC_GROUP_new_curve_GFp(const BIGNUM *p, const BIGNUM *a,
                                  const BIGNUM *b, BN_CTX *ctx);

EC_GROUP *EC_GROUP_new_curve_GF2m(const BIGNUM *p, const BIGNUM *a,
                                   const BIGNUM *b, BN_CTX *ctx);

EC_GROUP *EC_GROUP_new_by_curve_name_ex(OSSL_LIB_CTX *libctx, const char *propq,
```

```

        int nid);

EC_GROUP *EC_GROUP_new_by_curve_name(int nid);

int EC_GROUP_set_curve(EC_GROUP *group, const BIGNUM *p, const BIGNUM *a,
        const BIGNUM *b, BN_CTX *ctx);

int EC_GROUP_get_curve(const EC_GROUP *group, BIGNUM *p, BIGNUM *a, BIGNUM *b,
        BN_CTX *ctx);

ECPARAMETERS *EC_GROUP_get_ecparameters(const EC_GROUP *group,
        ECPARAMETERS *params);

ECPKPARAMETERS *EC_GROUP_get_ecpkparameters(const EC_GROUP *group,
        ECPKPARAMETERS *params);

size_t EC_get_builtin_curves(EC_builtin_curve *r, size_t nitems);

const char *OSSL_EC_curve_nid2name(int nid);

```

The following functions have been deprecated since OpenSSL 3.0, and can be hidden entirely by defining `OPENSSL_API_COMPAT` with a suitable version value, see `openssl_user_macros(7)`:

```

EC_GROUP *EC_GROUP_new(const EC_METHOD *meth);

void EC_GROUP_clear_free(EC_GROUP *group);

int EC_GROUP_set_curve_GFp(EC_GROUP *group, const BIGNUM *p,
        const BIGNUM *a, const BIGNUM *b, BN_CTX *ctx);

int EC_GROUP_get_curve_GFp(const EC_GROUP *group, BIGNUM *p,
        BIGNUM *a, BIGNUM *b, BN_CTX *ctx);

int EC_GROUP_set_curve_GF2m(EC_GROUP *group, const BIGNUM *p,
        const BIGNUM *a, const BIGNUM *b, BN_CTX *ctx);

int EC_GROUP_get_curve_GF2m(const EC_GROUP *group, BIGNUM *p,
        BIGNUM *a, BIGNUM *b, BN_CTX *ctx);

```

DESCRIPTION

Within the library there are two forms of elliptic curve that are of interest. The first form is those defined over the prime field F_p . The elements of F_p are the integers 0 to $p-1$, where p is a prime number.

This gives us a revised elliptic curve equation as follows:

$$y^2 \bmod p = x^3 + ax + b \bmod p$$

The second form is those defined over a binary field F_2^m where the elements of the field are integers of length at most m bits. For this

form the elliptic curve equation is modified to:

$$y^2 + xy = x^3 + ax^2 + b \text{ (where } b \neq 0)$$

Operations in a binary field are performed relative to an irreducible polynomial. All such curves with OpenSSL use a trinomial or a pentanomial for this parameter.

Although deprecated since OpenSSL 3.0 and should no longer be used, a new curve can be constructed by calling `EC_GROUP_new()`, using the implementation provided by `meth` (see `EC_GFp_simple_method(3)`) and associated with the library context `ctx` (see `OSSL_LIB_CTX(3)`). The `ctx` parameter may be `NULL` in which case the default library context is used. It is then necessary to call `EC_GROUP_set_curve()` to set the curve parameters. Applications should instead use one of the other `EC_GROUP_new_*` constructors.

`EC_GROUP_new_from_params()` creates a group with parameters specified by `params`. The library context `libctx` (see `OSSL_LIB_CTX(3)`) and property query string `propq` are used to fetch algorithms from providers. `params` may be either a list of explicit params or a named group, The values for `ctx` and `propq` may be `NULL`. The params that can be used are described in `EVP_PKEY-EC(7)`.

`EC_GROUP_new_from_ecparameters()` will create a group from the specified params and `EC_GROUP_new_from_ecpkparameters()` will create a group from the specific PK params.

`EC_GROUP_set_curve()` sets the curve parameters `p`, `a` and `b`. For a curve over F_p `p` is the prime for the field. For a curve over F_{2^m} `p` represents the irreducible polynomial - each bit represents a term in the polynomial. Therefore, there will either be three or five bits set dependent on whether the polynomial is a trinomial or a pentanomial.

In either case, `a` and `b` represents the coefficients `a` and `b` from the relevant equation introduced above.

`EC_group_get_curve()` obtains the previously set curve parameters.

`EC_GROUP_set_curve_GFp()` and `EC_GROUP_set_curve_GF2m()` are synonyms for `EC_GROUP_set_curve()`. They are defined for backwards compatibility only and should not be used.

`EC_GROUP_get_curve_GFp()` and `EC_GROUP_get_curve_GF2m()` are synonyms for `EC_GROUP_get_curve()`. They are defined for backwards compatibility only and should not be used.

The functions `EC_GROUP_new_curve_GFp()` and `EC_GROUP_new_curve_GF2m()` are shortcuts for calling `EC_GROUP_new()` and then the `EC_GROUP_set_curve()` function. An appropriate default implementation method will be used.

Whilst the library can be used to create any curve using the functions described above, there are also a number of predefined curves that are available. In order to obtain a list of all of the predefined curves, call the function `EC_get_builtin_curves()`. The parameter `r` should be an array of `EC_builtin_curve` structures of size `nitems`. The function will populate the `r` array with information about the built-in curves. If `nitems` is less than the total number of curves available, then the first `nitems` curves will be returned. Otherwise the total number of curves will be provided. The return value is the total number of curves available (whether that number has been populated in `r` or not). Passing a `NULL` `r`, or setting `nitems` to 0 will do nothing other than return the total number of curves available. The `EC_builtin_curve` structure is defined as follows:

```
typedef struct {
    int nid;
    const char *comment;
} EC_builtin_curve;
```

Each `EC_builtin_curve` item has a unique integer id (`nid`), and a human readable comment string describing the curve.

In order to construct a built-in curve use the function

`EC_GROUP_new_by_curve_name_ex()` and provide the `nid` of the curve to be constructed, the associated library context to be used in `ctx` (see `OSSL_LIB_CTX(3)`) and any property query string in `propq`. The `ctx` value may be `NULL` in which case the default library context is used. The `propq` value may also be `NULL`.

`EC_GROUP_new_by_curve_name()` is the same as

EC_GROUP_new_by_curve_name_ex() except that the default library context is always used along with a NULL property query string.

EC_GROUP_free() frees the memory associated with the EC_GROUP. If group is NULL nothing is done.

EC_GROUP_clear_free() is deprecated: it was meant to destroy any sensitive data held within the EC_GROUP and then free its memory, but since all the data stored in the EC_GROUP is public anyway, this function is unnecessary. Its use can be safely replaced with

EC_GROUP_free(). If group is NULL nothing is done.

OSSL_EC_curve_nid2name() converts a curve nid into the corresponding name.

RETURN VALUES

All EC_GROUP_new* functions return a pointer to the newly constructed group, or NULL on error.

EC_get_builtin_curves() returns the number of built-in curves that are available.

EC_GROUP_set_curve_GFp(), EC_GROUP_get_curve_GFp(),

EC_GROUP_set_curve_GF2m(), EC_GROUP_get_curve_GF2m() return 1 on success or 0 on error.

OSSL_EC_curve_nid2name() returns a character string constant, or NULL on error.

SEE ALSO

crypto(7), EC_GROUP_copy(3), EC_POINT_new(3), EC_POINT_add(3), EC_KEY_new(3), EC_GFp_simple_method(3), d2i_ECPKParameters(3), OSSL_LIB_CTX(3), EVP_PKEY-EC(7)

HISTORY

? EC_GROUP_new() was deprecated in OpenSSL 3.0.

EC_GROUP_new_by_curve_name_ex() and EC_GROUP_new_from_params() were added in OpenSSL 3.0.

? EC_GROUP_clear_free() was deprecated in OpenSSL 3.0; use EC_GROUP_free() instead.

?

EC_GROUP_set_curve_GFp(), EC_GROUP_get_curve_GFp(),

EC_GROUP_set_curve_GF2m() and EC_GROUP_get_curve_GF2m() were deprecated in OpenSSL 3.0; use EC_GROUP_set_curve() and EC_GROUP_get_curve() instead.

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