

NAME

EVP_PKEY_ASN1_METHOD, EVP_PKEY_asn1_new, EVP_PKEY_asn1_copy, EVP_PKEY_asn1_free, EVP_PKEY_asn1_add0, EVP_PKEY_asn1_add_alias, EVP_PKEY_asn1_set_public, EVP_PKEY_asn1_set_private, EVP_PKEY_asn1_set_param, EVP_PKEY_asn1_set_free, EVP_PKEY_asn1_set_ctrl, EVP_PKEY_asn1_set_item, EVP_PKEY_asn1_set_siginf, EVP_PKEY_asn1_set_check, EVP_PKEY_asn1_set_public_check, EVP_PKEY_asn1_set_param_check, EVP_PKEY_asn1_set_security_bits, EVP_PKEY_asn1_set_set_priv_key, EVP_PKEY_asn1_set_set_pub_key, EVP_PKEY_asn1_set_get_priv_key, EVP_PKEY_asn1_set_get_pub_key, EVP_PKEY_get0_asn1 - manipulating and registering EVP_PKEY_ASN1_METHOD structure

SYNOPSIS

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

```
typedef struct evp_pkey_asn1_method_st EVP_PKEY_ASN1_METHOD;
```

```
EVP_PKEY_ASN1_METHOD *EVP_PKEY_asn1_new(int id, int flags,
                                         const char *pem_str,
                                         const char *info);
```

```
void EVP_PKEY_asn1_copy(EVP_PKEY_ASN1_METHOD *dst,
                       const EVP_PKEY_ASN1_METHOD *src);
```

```
void EVP_PKEY_asn1_free(EVP_PKEY_ASN1_METHOD *ameth);
```

```
int EVP_PKEY_asn1_add0(const EVP_PKEY_ASN1_METHOD *ameth);
```

```
int EVP_PKEY_asn1_add_alias(int to, int from);
```

```
void EVP_PKEY_asn1_set_public(EVP_PKEY_ASN1_METHOD *ameth,
                              int (*pub_decode) (EVP_PKEY *pk,
                                                  const X509_PUBKEY *pub),
                              int (*pub_encode) (X509_PUBKEY *pub,
                                                  const EVP_PKEY *pk),
                              int (*pub_cmp) (const EVP_PKEY *a,
                                               const EVP_PKEY *b),
                              int (*pub_print) (BIO *out,
                                                const EVP_PKEY *pkey,
                                                int indent, ASN1_PCTX *pctx),
                              int (*pkey_size) (const EVP_PKEY *pk),
                              int (*pkey_bits) (const EVP_PKEY *pk));
```

```
void EVP_PKEY_asn1_set_private(EVP_PKEY_ASN1_METHOD *ameth,
                               int (*priv_decode) (EVP_PKEY *pk,
                                                    const PKCS8_PRIV_KEY_INFO
```

```
        *p8inf),
    int (*priv_encode) (PKCS8_PRIV_KEY_INFO *p8,
        const EVP_PKEY *pk),
    int (*priv_print) (BIO *out,
        const EVP_PKEY *pkey,
        int indent,
        ASN1_PCTX *pctx));
void EVP_PKEY_asn1_set_param(EVP_PKEY_ASN1_METHOD *ameth,
    int (*param_decode) (EVP_PKEY *pkey,
        const unsigned char **pder,
        int derlen),
    int (*param_encode) (const EVP_PKEY *pkey,
        unsigned char **pder),
    int (*param_missing) (const EVP_PKEY *pk),
    int (*param_copy) (EVP_PKEY *to,
        const EVP_PKEY *from),
    int (*param_cmp) (const EVP_PKEY *a,
        const EVP_PKEY *b),
    int (*param_print) (BIO *out,
        const EVP_PKEY *pkey,
        int indent,
        ASN1_PCTX *pctx));

void EVP_PKEY_asn1_set_free(EVP_PKEY_ASN1_METHOD *ameth,
    void (*pkey_free) (EVP_PKEY *pkey));
void EVP_PKEY_asn1_set_ctrl(EVP_PKEY_ASN1_METHOD *ameth,
    int (*pkey_ctrl) (EVP_PKEY *pkey, int op,
        long arg1, void *arg2));
void EVP_PKEY_asn1_set_item(EVP_PKEY_ASN1_METHOD *ameth,
    int (*item_verify) (EVP_MD_CTX *ctx,
        const ASN1_ITEM *it,
        void *asn,
        X509_ALGOR *a,
        ASN1_BIT_STRING *sig,
        EVP_PKEY *pkey),
    int (*item_sign) (EVP_MD_CTX *ctx,
        const ASN1_ITEM *it,
        void *asn,
        X509_ALGOR *alg1,
        X509_ALGOR *alg2,
```

```
ASN1_BIT_STRING *sig));

void EVP_PKEY_asn1_set_siginf(EVP_PKEY_ASN1_METHOD *ameth,
    int (*siginf_set) (X509_SIG_INFO *siginf,
        const X509_ALGOR *alg,
        const ASN1_STRING *sig));

void EVP_PKEY_asn1_set_check(EVP_PKEY_ASN1_METHOD *ameth,
    int (*pkey_check) (const EVP_PKEY *pk));

void EVP_PKEY_asn1_set_public_check(EVP_PKEY_ASN1_METHOD *ameth,
    int (*pkey_pub_check) (const EVP_PKEY *pk));

void EVP_PKEY_asn1_set_param_check(EVP_PKEY_ASN1_METHOD *ameth,
    int (*pkey_param_check) (const EVP_PKEY *pk));

void EVP_PKEY_asn1_set_security_bits(EVP_PKEY_ASN1_METHOD *ameth,
    int (*pkey_security_bits) (const EVP_PKEY
        *pk));

void EVP_PKEY_asn1_set_set_priv_key(EVP_PKEY_ASN1_METHOD *ameth,
    int (*set_priv_key) (EVP_PKEY *pk,
        const unsigned char
            *priv,
        size_t len));

void EVP_PKEY_asn1_set_set_pub_key(EVP_PKEY_ASN1_METHOD *ameth,
    int (*set_pub_key) (EVP_PKEY *pk,
        const unsigned char *pub,
        size_t len));

void EVP_PKEY_asn1_set_get_priv_key(EVP_PKEY_ASN1_METHOD *ameth,
    int (*get_priv_key) (const EVP_PKEY *pk,
        unsigned char *priv,
        size_t *len));

void EVP_PKEY_asn1_set_get_pub_key(EVP_PKEY_ASN1_METHOD *ameth,
    int (*get_pub_key) (const EVP_PKEY *pk,
        unsigned char *pub,
        size_t *len));
```

```
const EVP_PKEY_ASN1_METHOD *EVP_PKEY_get0_asn1(const EVP_PKEY *pkey);
```

DESCRIPTION

EVP_PKEY_ASN1_METHOD is a structure which holds a set of ASN.1 conversion, printing and information methods for a specific public key algorithm.

There are two places where the **EVP_PKEY_ASN1_METHOD** objects are stored: one is a built-in array representing the standard methods for different algorithms, and the other one is a stack of user-defined application-specific methods, which can be manipulated by using **EVP_PKEY_asn1_add0(3)**.

Methods

The methods are the underlying implementations of a particular public key algorithm present by the **EVP_PKEY** object.

```
int (*pub_decode) (EVP_PKEY *pk, const X509_PUBKEY *pub);
int (*pub_encode) (X509_PUBKEY *pub, const EVP_PKEY *pk);
int (*pub_cmp) (const EVP_PKEY *a, const EVP_PKEY *b);
int (*pub_print) (BIO *out, const EVP_PKEY *pkey, int indent,
                 ASN1_PCTX *pctx);
```

The **pub_decode()** and **pub_encode()** methods are called to decode / encode **X509_PUBKEY** ASN.1 parameters to / from **pk**. They MUST return 0 on error, 1 on success. They're called by **X509_PUBKEY_get0(3)** and **X509_PUBKEY_set(3)**.

The **pub_cmp()** method is called when two public keys are to be compared. It MUST return 1 when the keys are equal, 0 otherwise. It's called by **EVP_PKEY_eq(3)**.

The **pub_print()** method is called to print a public key in humanly readable text to **out**, indented **indent** spaces. It MUST return 0 on error, 1 on success. It's called by **EVP_PKEY_print_public(3)**.

```
int (*priv_decode) (EVP_PKEY *pk, const PKCS8_PRIV_KEY_INFO *p8inf);
int (*priv_encode) (PKCS8_PRIV_KEY_INFO *p8, const EVP_PKEY *pk);
int (*priv_print) (BIO *out, const EVP_PKEY *pkey, int indent,
                 ASN1_PCTX *pctx);
```

The **priv_decode()** and **priv_encode()** methods are called to decode / encode **PKCS8_PRIV_KEY_INFO** form private key to / from **pk**. They MUST return 0 on error, 1 on success. They're called by **EVP_PKCS82PKEY(3)** and **EVP_PKEY2PKCS8(3)**.

The **priv_print()** method is called to print a private key in humanly readable text to **out**, indented **indent**

spaces. It MUST return 0 on error, 1 on success. It's called by **EVP_PKEY_print_private(3)**.

```
int (*pkey_size) (const EVP_PKEY *pk);
int (*pkey_bits) (const EVP_PKEY *pk);
int (*pkey_security_bits) (const EVP_PKEY *pk);
```

The **pkey_size()** method returns the key size in bytes. It's called by **EVP_PKEY_get_size(3)**.

The **pkey_bits()** method returns the key size in bits. It's called by **EVP_PKEY_get_bits(3)**.

```
int (*param_decode) (EVP_PKEY *pkey,
                    const unsigned char **pder, int derlen);
int (*param_encode) (const EVP_PKEY *pkey, unsigned char **pder);
int (*param_missing) (const EVP_PKEY *pk);
int (*param_copy) (EVP_PKEY *to, const EVP_PKEY *from);
int (*param_cmp) (const EVP_PKEY *a, const EVP_PKEY *b);
int (*param_print) (BIO *out, const EVP_PKEY *pkey, int indent,
                  ASN1_PCTX *pctx);
```

The **param_decode()** and **param_encode()** methods are called to decode / encode DER formatted parameters to / from **pk**. They MUST return 0 on error, 1 on success. They're called by **PEM_read_bio_Parameters(3)** and the **file: OSSL_STORE_LOADER(3)**.

The **param_missing()** method returns 0 if a key parameter is missing, otherwise 1. It's called by **EVP_PKEY_missing_parameters(3)**.

The **param_copy()** method copies key parameters from **from** to **to**. It MUST return 0 on error, 1 on success. It's called by **EVP_PKEY_copy_parameters(3)**.

The **param_cmp()** method compares the parameters of keys **a** and **b**. It MUST return 1 when the keys are equal, 0 when not equal, or a negative number on error. It's called by **EVP_PKEY_parameters_eq(3)**.

The **param_print()** method prints the private key parameters in humanly readable text to **out**, indented **indent** spaces. It MUST return 0 on error, 1 on success. It's called by **EVP_PKEY_print_params(3)**.

```
int (*sig_print) (BIO *out,
                const X509_ALGOR *sigalg, const ASN1_STRING *sig,
                int indent, ASN1_PCTX *pctx);
```

The **sig_print()** method prints a signature in humanly readable text to **out**, indented **indent** spaces. **sigalg** contains the exact signature algorithm. If the signature in **sig** doesn't correspond to what this method expects, **X509_signature_dump()** must be used as a last resort. It MUST return 0 on error, 1 on success. It's called by **X509_signature_print(3)**.

```
void (*pkey_free) (EVP_PKEY *pkey);
```

The **pkey_free()** method helps freeing the internals of **pkey**. It's called by **EVP_PKEY_free(3)**, **EVP_PKEY_set_type(3)**, **EVP_PKEY_set_type_str(3)**, and **EVP_PKEY_assign(3)**.

```
int (*pkey_ctrl) (EVP_PKEY *pkey, int op, long arg1, void *arg2);
```

The **pkey_ctrl()** method adds extra algorithm specific control. It's called by **EVP_PKEY_get_default_digest_nid(3)**, **EVP_PKEY_set1_encoded_public_key(3)**, **EVP_PKEY_get1_encoded_public_key(3)**, **PKCS7_SIGNER_INFO_set(3)**, **PKCS7_RECIP_INFO_set(3)**, ...

```
int (*old_priv_decode) (EVP_PKEY *pkey,
                       const unsigned char **pder, int derlen);
int (*old_priv_encode) (const EVP_PKEY *pkey, unsigned char **pder);
```

The **old_priv_decode()** and **old_priv_encode()** methods decode / encode they private key **pkey** from / to a DER formatted array. These are exclusively used to help decoding / encoding older (pre PKCS#8) PEM formatted encrypted private keys. **old_priv_decode()** MUST return 0 on error, 1 on success. **old_priv_encode()** MUST the return same kind of values as **i2d_PrivateKey()**. They're called by **d2i_PrivateKey(3)** and **i2d_PrivateKey(3)**.

```
int (*item_verify) (EVP_MD_CTX *ctx, const ASN1_ITEM *it, void *asn,
                  X509_ALGOR *a, ASN1_BIT_STRING *sig, EVP_PKEY *pkey);
int (*item_sign) (EVP_MD_CTX *ctx, const ASN1_ITEM *it, void *asn,
                 X509_ALGOR *alg1, X509_ALGOR *alg2,
                 ASN1_BIT_STRING *sig);
```

The **item_sign()** and **item_verify()** methods make it possible to have algorithm specific signatures and verification of them.

item_sign() MUST return one of:

<=0 error

- 1 **item_sign()** did everything, OpenSSL internals just needs to pass the signature length back.
- 2 **item_sign()** did nothing, OpenSSL internal standard routines are expected to continue with the default signature production.
- 3 **item_sign()** set the algorithm identifier **algor1** and **algor2**, OpenSSL internals should just sign using those algorithms.

item_verify() MUST return one of:

<=0 error

- 1 **item_sign()** did everything, OpenSSL internals just needs to pass the signature length back.
- 2 **item_sign()** did nothing, OpenSSL internal standard routines are expected to continue with the default signature production.

item_verify() and **item_sign()** are called by **ASN1_item_verify(3)** and **ASN1_item_sign(3)**, and by extension, **X509_verify(3)**, **X509_REQ_verify(3)**, **X509_sign(3)**, **X509_REQ_sign(3)**, ...

```
int (*siginf_set) (X509_SIG_INFO *siginf, const X509_ALGOR *alg,
                  const ASN1_STRING *sig);
```

The **siginf_set()** method is used to set custom **X509_SIG_INFO** parameters. It MUST return 0 on error, or 1 on success. It's called as part of **X509_check_purpose(3)**, **X509_check_ca(3)** and **X509_check_issued(3)**.

```
int (*pkey_check) (const EVP_PKEY *pk);
int (*pkey_public_check) (const EVP_PKEY *pk);
int (*pkey_param_check) (const EVP_PKEY *pk);
```

The **pkey_check()**, **pkey_public_check()** and **pkey_param_check()** methods are used to check the validity of **pk** for key-pair, public component and parameters, respectively. They MUST return 0 for an invalid key, or 1 for a valid key. They are called by **EVP_PKEY_check(3)**, **EVP_PKEY_public_check(3)** and **EVP_PKEY_param_check(3)** respectively.

```
int (*set_priv_key) (EVP_PKEY *pk, const unsigned char *priv, size_t len);
int (*set_pub_key) (EVP_PKEY *pk, const unsigned char *pub, size_t len);
```

The **set_priv_key()** and **set_pub_key()** methods are used to set the raw private and public key data for

an `EVP_PKEY`. They **MUST** return 0 on error, or 1 on success. They are called by `EVP_PKEY_new_raw_private_key(3)`, and `EVP_PKEY_new_raw_public_key(3)` respectively.

```
size_t (*dirty) (const EVP_PKEY *pk);
void *(*export_to) (const EVP_PKEY *pk, EVP_KEYMGMT *keymgmt);
```

`dirty_cnt()` returns the internal key's dirty count. This can be used to synchronise different copies of the same keys.

The `export_to()` method exports the key material from the given key to a provider, through the `EVP_KEYMGMT(3)` interface, if that provider supports importing key material.

Functions

`EVP_PKEY_asn1_new()` creates and returns a new `EVP_PKEY_ASN1_METHOD` object, and associates the given `id`, `flags`, `pem_str` and `info`. `id` is a NID, `pem_str` is the PEM type string, `info` is a descriptive string. The following `flags` are supported:

`ASN1_PKEY_SIGPARAM_NULL`

If `ASN1_PKEY_SIGPARAM_NULL` is set, then the signature algorithm parameters are given the type `V_ASN1_NULL` by default, otherwise they will be given the type `V_ASN1_UNDEF` (i.e. the parameter is omitted). See `X509_ALGOR_set0(3)` for more information.

`EVP_PKEY_asn1_copy()` copies an `EVP_PKEY_ASN1_METHOD` object from `src` to `dst`. This function is not thread safe, it's recommended to only use this when initializing the application.

`EVP_PKEY_asn1_free()` frees an existing `EVP_PKEY_ASN1_METHOD` pointed by `ameth`.

`EVP_PKEY_asn1_add0()` adds `ameth` to the user defined stack of methods unless another `EVP_PKEY_ASN1_METHOD` with the same NID is already there. This function is not thread safe, it's recommended to only use this when initializing the application.

`EVP_PKEY_asn1_add_alias()` creates an alias with the NID `to` for the `EVP_PKEY_ASN1_METHOD` with NID `from` unless another `EVP_PKEY_ASN1_METHOD` with the same NID is already added. This function is not thread safe, it's recommended to only use this when initializing the application.

`EVP_PKEY_asn1_set_public()`, `EVP_PKEY_asn1_set_private()`, `EVP_PKEY_asn1_set_param()`, `EVP_PKEY_asn1_set_free()`, `EVP_PKEY_asn1_set_ctrl()`, `EVP_PKEY_asn1_set_item()`, `EVP_PKEY_asn1_set_siginf()`, `EVP_PKEY_asn1_set_check()`, `EVP_PKEY_asn1_set_public_check()`, `EVP_PKEY_asn1_set_param_check()`, `EVP_PKEY_asn1_set_security_bits()`,

EVP_PKEY_asn1_set_set_priv_key(), **EVP_PKEY_asn1_set_set_pub_key()**, **EVP_PKEY_asn1_set_get_priv_key()** and **EVP_PKEY_asn1_set_get_pub_key()** set the diverse methods of the given **EVP_PKEY_ASN1_METHOD** object.

EVP_PKEY_get0_asn1() finds the **EVP_PKEY_ASN1_METHOD** associated with the key **pkey**.

RETURN VALUES

EVP_PKEY_asn1_new() returns NULL on error, or a pointer to an **EVP_PKEY_ASN1_METHOD** object otherwise.

EVP_PKEY_asn1_add0() and **EVP_PKEY_asn1_add_alias()** return 0 on error, or 1 on success.

EVP_PKEY_get0_asn1() returns NULL on error, or a pointer to a constant **EVP_PKEY_ASN1_METHOD** object otherwise.

HISTORY

The signature of the *pub_decode* functional argument of **EVP_PKEY_asn1_set_public()** has changed in OpenSSL 3.0 so its *pub* parameter is now constified.

COPYRIGHT

Copyright 2017-2021 The OpenSSL Project Authors. All Rights Reserved.

Licensed under the Apache License 2.0 (the "License"). You may not use this file except in compliance with the License. You can obtain a copy in the file LICENSE in the source distribution or at <<https://www.openssl.org/source/license.html>>.