

**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

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