攻防世界 · Normal_RSA · wp

原创

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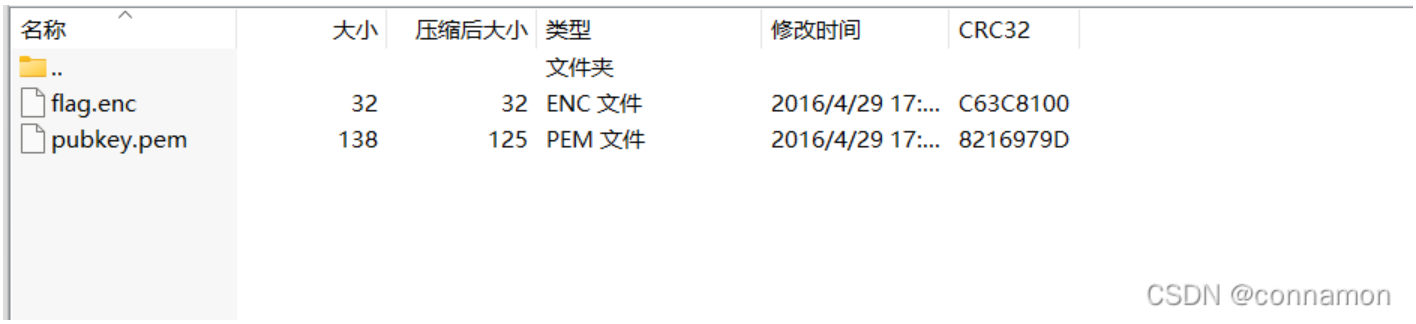
文章标签： 网络安全

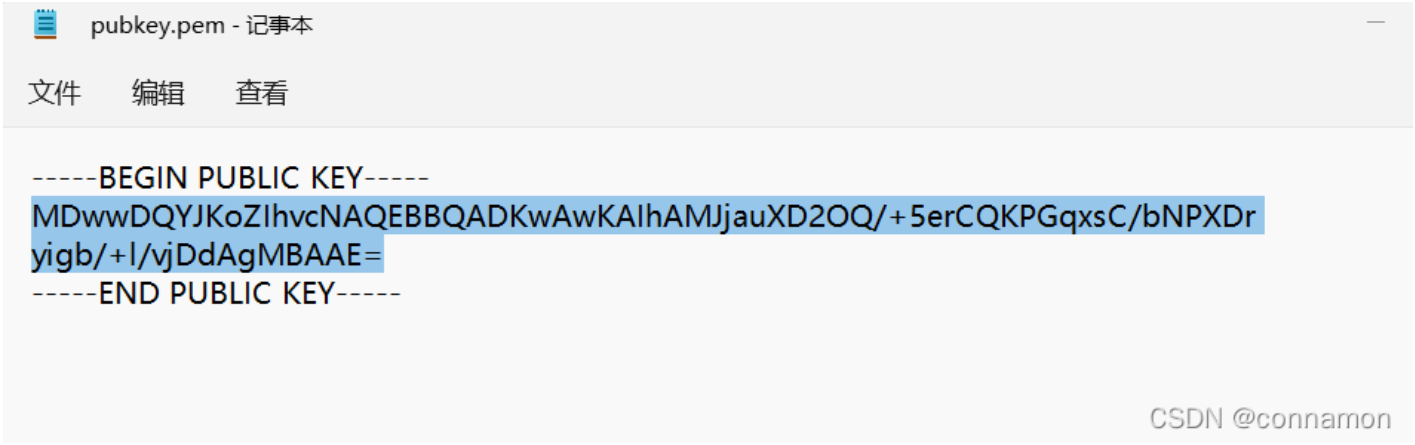
本文链接：https://blog.csdn.net/sml1918451478/article/details/123886833

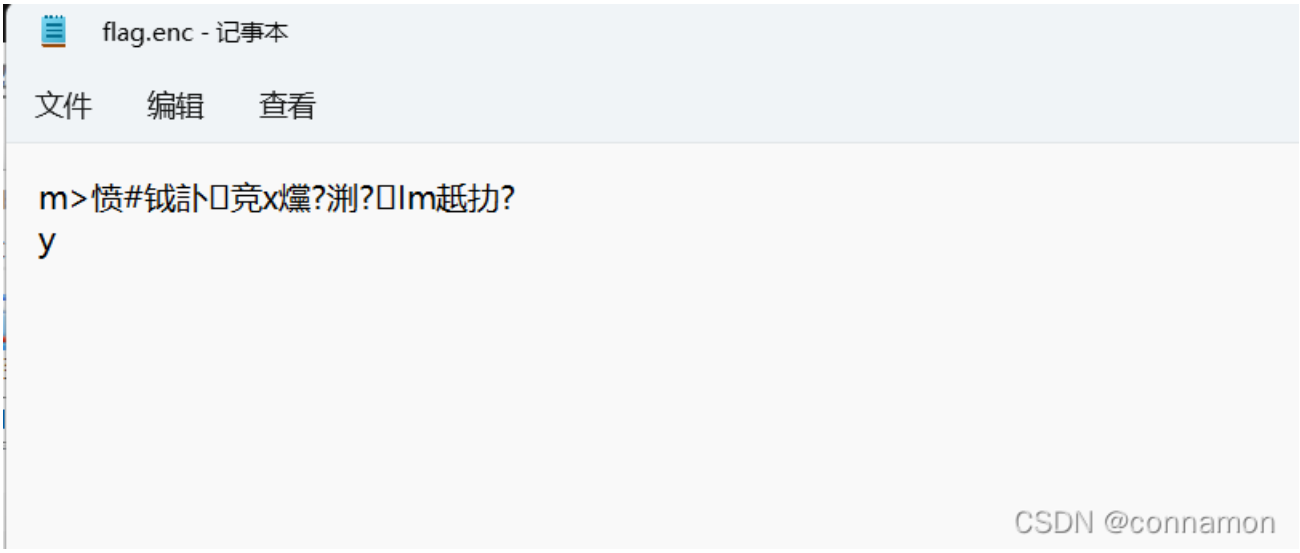
附件情况

enc后缀：用于通过在UUenconded格式文件，它们是加密的文

pem后缀：PEM文件是用于对安全网站进行身份验证的Base64编码的证书文件，它可能包含私钥、证书颁发机构（CA）服务器证书或组成信任链的其他各种证书。PEM文件通常从基于Linux的Apache或Nginx Web服务器中导入，并且与OpenSSL应用程序兼容。



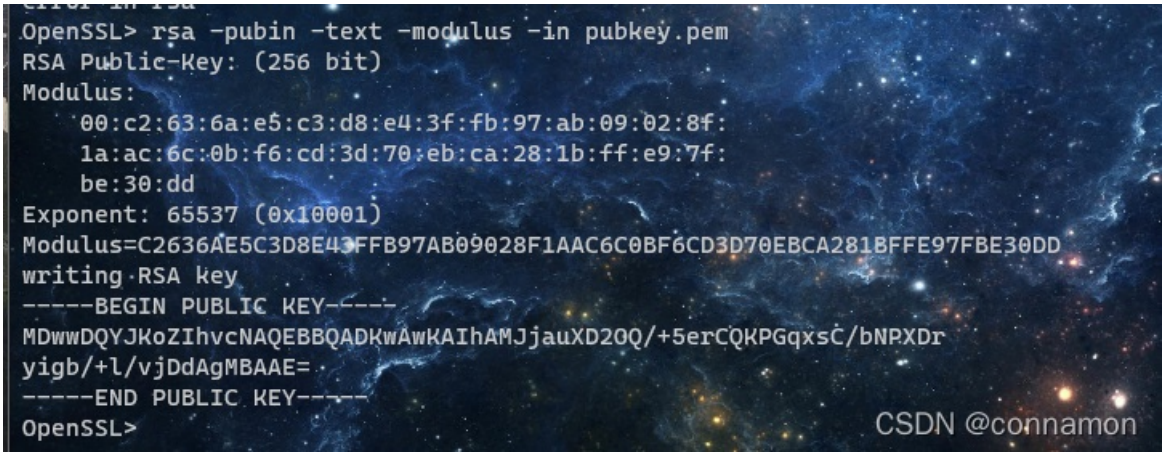




发现有base64编码，但是并没有什么办法解码

发现flag文件没有办法打开，那就用记事本、openssl打开pubkey文件

```
openssl rsa -pubin -text -modulus -in warmup -in pubkey.pem
```



e=65537

n=p*q=C2636AE5C3D8E43FFB97AB09028F1AAC6C0BF6CD3D70EBCA281BFFE97FBE30DD（十六进制）

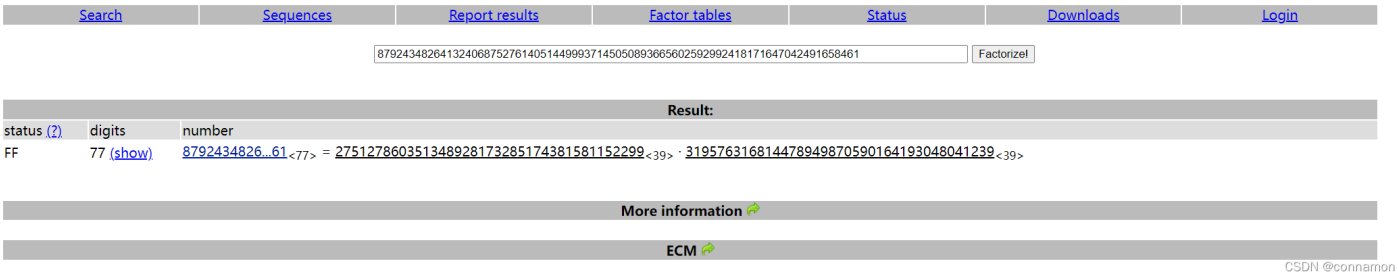
n=108669487608445991682520826123784959773882712796792315398390496986219949946 73（十进制）

利用素数分解分解出p和q

p=275127860351348928173285174381581152299

q=319576316814478949870590164193048041239

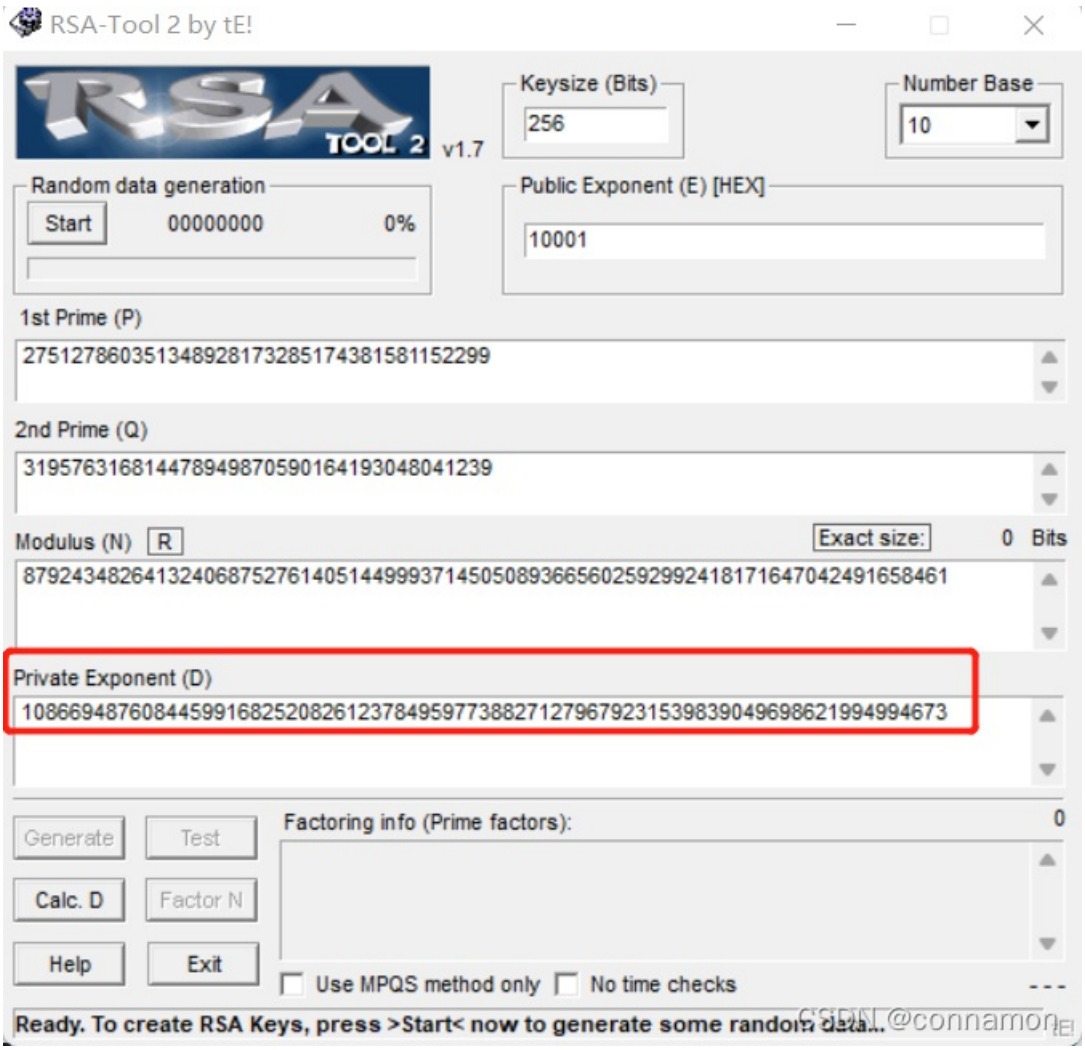
素因子分解工具：factordb.com



利用rsatool计算d

d=10866948760844599168252082612378495977388271279679231539839049698621994994673

rsa工具下载请查看buuctf·rsarsa·wp文章



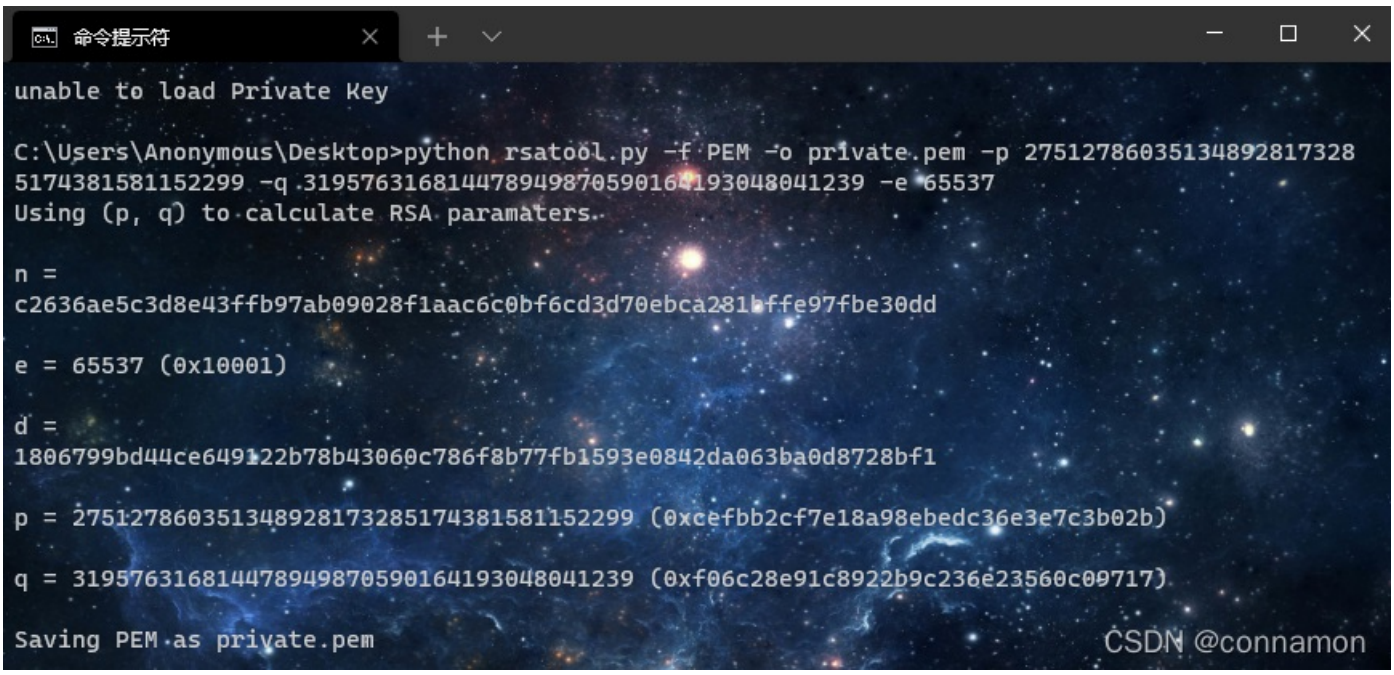
解出了之后发现没有密文，换条思路，查看一下wp

下载一个工具rsatool.py脚本

运行脚本之后在终端输入命令，需要先安装gmpy2

```
pip install gmpy2
```

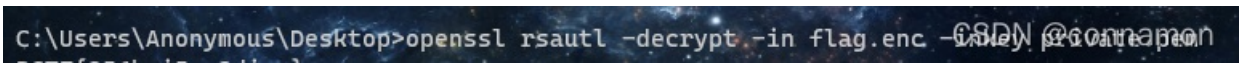
```
python rsatool.py -f PEM -o private.pem -p 275127860351348928173285174381581152299 -q 319576316814478949870
```



即可生成private.pem文件

最后用其解开flag.enc文件，在终端输入：

```
openssl rsautl -decrypt -in flag.enc -inkey private.pem
```



rsatool脚本rsatool/rsatool.py at master · ius/rsatool (github.com)

```
#!/usr/bin/env python3
import base64
import argparse
import random
import sys
import textwrap

import gmpy2

from pyasn1.codec.der import encoder
from pyasn1.type.univ import Sequence, Integer

PEM_TEMPLATE = (
    '-----BEGIN RSA PRIVATE KEY-----\n'
    '%s\n'
    '-----END RSA PRIVATE KEY-----\n'
)

DEFAULT_EXP = 65537
```

```
def factor_modulus(n, d, e):
    """
    Efficiently recover non-trivial factors of n
    See: Handbook of Applied Cryptography
    8.2.2 Security of RSA -> (i) Relation to factoring (p.287)
    http://www.cacr.math.uwaterloo.ca/hac/
    """
    t = e * d - 1
    s = 0

    if 17 != gmpy2.powmod(17, e * d, n):
        raise ValueError("n, d, e don't match")

    while True:
        quotient, remainder = divmod(t, 2)

        if remainder != 0:
            break

        s += 1
        t = quotient

    found = False

    while not found:
        i = 1
        a = random.randint(1, n - 1)

        while i <= s and not found:
            c1 = pow(a, pow(2, i - 1, n) * t, n)
            c2 = pow(a, pow(2, i, n) * t, n)

            found = c1 != 1 and c1 != (-1 % n) and c2 == 1

            i += 1

    p = gmpy2.gcd(c1 - 1, n)
    q = n // p

    return p, q


class RSA:
    def __init__(self, p=None, q=None, n=None, d=None, e=DEFAULT_EXP):
        """
        Initialize RSA instance using primes (p, q)
        or modulus and private exponent (n, d)
        """

        self.e = e

        if p and q:
            assert gmpy2.is_prime(p), 'p is not prime'
            assert gmpy2.is_prime(q), 'q is not prime'

            self.p = p
            self.q = q
        elif n and d:
```

```
            self.p, self.q = factor_modulus(n, d, e)
        else:
            raise ValueError('Either (p, q) or (n, d) must be provided')

        self._calc_values()

    def _calc_values(self):
        self.n = self.p * self.q

        if self.p != self.q:
            phi = (self.p - 1) * (self.q - 1)
        else:
            phi = (self.p ** 2) - self.p

        self.d = gmpy2.invert(self.e, phi)

        # CRT-RSA precomputation
        self.dP = self.d % (self.p - 1)
        self.dQ = self.d % (self.q - 1)
        self.qInv = gmpy2.invert(self.q, self.p)

    def to_pem(self):
        """
        Return OpenSSL-compatible PEM encoded key
        """
        b64 = base64.b64encode(self.to_der()).decode()
        b64w = "\n".join(textwrap.wrap(b64, 64))
        return (PEM_TEMPLATE % b64w).encode()

    def to_der(self):
        """
        Return parameters as OpenSSL compatible DER encoded key
        """
        seq = Sequence()

        for idx, x in enumerate(
            [0, self.n, self.e, self.d, self.p, self.q, self.dP, self.dQ, self.qInv]
        ):
            seq.setComponentByPosition(idx, Integer(x))

        return encoder.encode(seq)

    def dump(self, verbose):
        vars = ['n', 'e', 'd', 'p', 'q']

        if verbose:
            vars += ['dP', 'dQ', 'qInv']

        for v in vars:
            self._dumpvar(v)

    def _dumpvar(self, var):
        val = getattr(self, var)

        def parts(s, n):
            return '\n'.join([s[i:i + n] for i in range(0, len(s), n)])

        if len(str(val)) <= 40:
            print('%s = %d (%#x)\n' % (var, val, val))
        else:
```

```
        else:
            print('%s =' % var)
            print(parts('%x' % val, 80) + '\n')


if __name__ == '__main__':
    parser = argparse.ArgumentParser()

    parser.add_argument('-n', type=lambda x: int(x, 0),
                        help='modulus. format : int or 0xhex')
    parser.add_argument('-p', type=lambda x: int(x, 0),
                        help='first prime number. format : int or 0xhex')
    parser.add_argument('-q', type=lambda x: int(x, 0),
                        help='second prime number. format : int or 0xhex')
    parser.add_argument('-d', type=lambda x: int(x, 0),
                        help='private exponent. format : int or 0xhex')
    parser.add_argument('-e', type=lambda x: int(x, 0),
                        help='public exponent (default: %d). format : int or 0xhex' %
                        DEFAULT_EXP, default=DEFAULT_EXP)
    parser.add_argument('-o', '--output', help='output filename')
    parser.add_argument('-f', '--format', choices=['DER', 'PEM'], default='PEM',
                        help='output format (DER, PEM) (default: PEM)')
    parser.add_argument('-v', '--verbose', action='store_true', default=False,
                        help='also display CRT-RSA representation')

    args = parser.parse_args()

    if args.p and args.q:
        print('Using (p, q) to calculate RSA paramaters\n')
        rsa = RSA(p=args.p, q=args.q, e=args.e)
    elif args.n and args.d:
        print('Using (n, d) to calculate RSA parameters\n')
        rsa = RSA(n=args.n, d=args.d, e=args.e)
    else:
        parser.print_help()
        parser.error('Either (p, q) or (n, d) needs to be specified')

    if args.format == 'DER' and not args.output:
        parser.error('Output filename (-o) required for DER output')

    rsa.dump(args.verbose)

    if args.format == 'PEM':
        data = rsa.to_pem()
    elif args.format == 'DER':
        data = rsa.to_der()

    if args.output:
        print('Saving %s as %s' % (args.format, args.output))

        fp = open(args.output, 'wb')
        fp.write(data)
        fp.close()
    else:
        sys.stdout.buffer.write(data)
```