EOS 权限系统与签名认证

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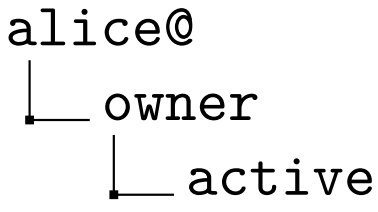
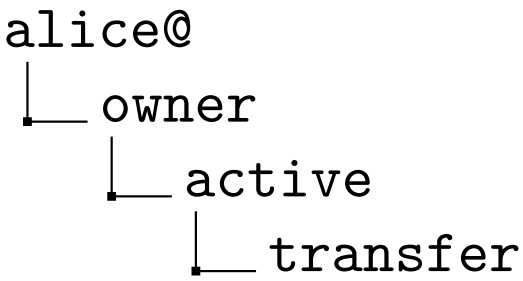
Outline

Permission

$ cleos set account permission [account] [permission] [authority] [parent]

```
cleos set account permission alice transfer
 ↪  '{"threshold":1,"keys":[], "accounts":[]}' "active" -p
 ↪  alice@active
```





Authority

- Threshold
- Keys
- Accounts
- Waits

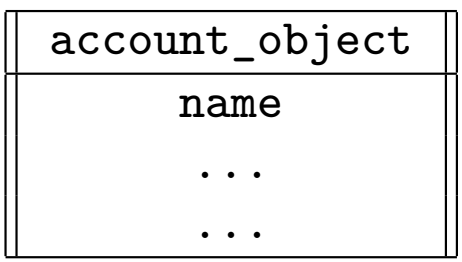
`active@alice`

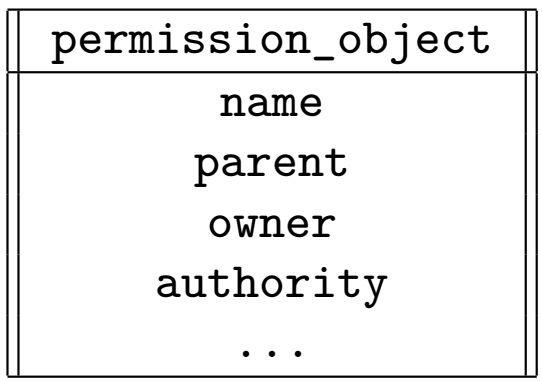

```
{
  "threshold": 2,
  "keys": [
    {
      "key": "EOS6fzbrDV6qL99HatqAKM2dSdUVQmiDsZsD2K58YQ3MXL4CBphN5",
      "weight": 1
    },
    {
      "key": "EOS7VJkEQhQw3JQNGhGwbX3oH3AEZExia5cTZzSH1fm3y7HNVueck",
      "weight": 1
    }
  ],
  "accounts": [
    {
      "permission": {
        "actor": "bob",
        "permission": "eosio.code"
      },
      "weight": 2
    }
  ],
  "waits": [
    {
      "wait_sec": "3600",
      "weight": 1
    }
  ]
}
```

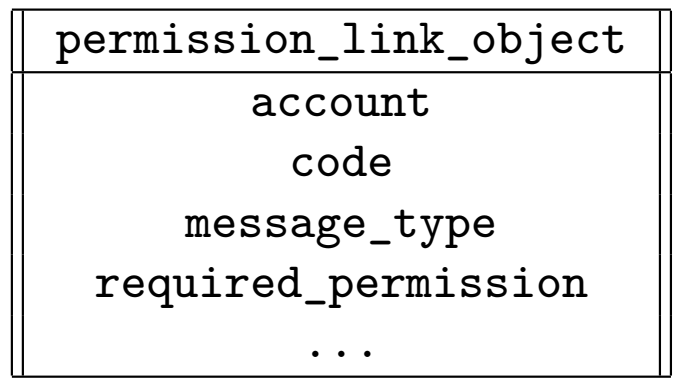
Permission Link

Accounts and Permissions are stored in the chain state database.
See: bytemaster/ChainBase

$ cleos set action permission [account] [code] [type] [requirement]







Push Transaction

使用 eosjs 和 eosjs-ecc 这两个项目来分析整个签名过程。现在我们要发送一个包含如下 action 的 transaction。完整代码：sign-trx-demo/index.js

```
const action = {
  account: 'eosio',
  name: 'newaccount',
  authorization: [{
    actor: 'eosio',
    permission: 'active',
  }],
  data: {
    creator: 'eosio',
    name: 'alice',
    owner: {
      threshold: 1,
      keys: [{
        key: 'EOS6MRyAjQq8ud7hVNYcfnVPJqcVpscN5So8BhtHuGYqET5GDW5CV',
        weight: 1
      }],
      accounts: [],
      waits: []
    },
    active: {
      threshold: 1,
      keys: [{
        key: 'EOS6MRyAjQq8ud7hVNYcfnVPJqcVpscN5So8BhtHuGYqET5GDW5CV',
        weight: 1
      }],
      accounts: [],
      waits: []
    },
  },
};
```

Procedure Source Code

1. eosjs/src/eosjs-api.ts:214 transact()
2. eos/src/eosjs-jssig.ts:33 sign()
3. eosjs-ecc/src/signature:117 Signature.sign()
4. eosjs-ecc/src/signature.js:195 Signature.signHash()
5. eosjs-ecc/src/signature.js:195 Signature.toBuffer()
6. eosjs-ecc/src/signature.js:195 Signature.toString()
7. eosjs-ecc/src/key_utils.js:181 checkEncode()

Pseudo Code

```
1  action.data = abi.serialize( action.data )
2  transaction = { ..., actions }
3  digest = sha256( concat( chain_id, serialize(transaction), buffer[32] ) )
4  signature = concat( i, ecc.encrypt( digest, private_key ) )
5  checksum = ripemd160( concat(signature, type) )
6  text = concat( 'SIG_K1_', base58.encode( concat( signature, checksum ) ) )
```

Output Log

transaction


```
{
  "expiration":"2019-05-09T19:08:13.000",
  "ref_block_num":12516,
  "ref_block_prefix":3102567877,
  "actions":[
    {
      "account":"eosio",
      "name":"newaccount",
      "authorization":[
        {
          "actor":"eosio",
          "permission":"active"
        }
      ],
      "data":"0000000000EA30550000000000855C3401000000010002C0DED2BC1F1305FB0FAAC5E6C03EE3A1924
      ↪    234985427B6167CA569D13DF435CF0100000001000000010002C0DED2BC1F1305FB0FAAC5E6C03EE3
      ↪    A1924234985427B6167CA569D13DF435CF01000000"
    }
  ]
}
```


digest


```
c4822b63ba2960e4bab2700b201b525af173744f911de5d0ff4ce5bac11da070
```


text


```
SIG_K1_KfqCE8YMXnKdC79ihnFejau37XkVMELpmtfuJPGdS4aTN5ypmb9iXyPsAFVZ8akJC2uvXxq5M8jFqmfoFV51Wvpba55d85
```

Public Key Recovery

Public key can be recovered from original content, ECDSA signature and extra public key information.

`public_key = recover( signature, digest )`

eos/libraries/chain/transaction.cpp:98 transaction::get_signature_keys()

```
1   recovered_pub_keys.clear();
2   const digest_type digest = sig_digest(chain_id, cfd);
3   // c4822b63ba2960e4bab2700b201b525af173744f911de5d0ff4ce5bac11da070
4   std::unique_lock<std::mutex> lock(cache_mtx, std::defer_lock);
5   fc::microseconds sig_cpu_usage;
6   for(const signature_type& sig : signatures) {
7     auto now = fc::time_point::now();
8     EOS_ASSERT( now < deadline, tx_cpu_usage_exceeded, "transaction signature verification executed for too
9                 ("now", now)("deadline", deadline)("start", start) );
10    public_key_type recov;
11    const auto& tid = id();
12    lock.lock();
13    recovery_cache_type::index<by_sig>::type::iterator it = recovery_cache.get<by_sig>().find( sig );
14    if( it == recovery_cache.get<by_sig>().end() || it->trx_id != tid ) {
15       lock.unlock();
16       recov = public_key_type( sig, digest );
17       fc::microseconds cpu_usage = fc::time_point::now() - start;
18       lock.lock();
19       recovery_cache.emplace_back( cached_pub_key{tid, recov, sig, cpu_usage} ); //could fail on dup signat
20       sig_cpu_usage += cpu_usage;
21    } else {
22       recov = it->pub_key;
23       sig_cpu_usage += it->cpu_usage;
24    }
25    lock.unlock();
26    ...
27  }
```

Multi-threaded recovery

Release 1.5.0 introduces the support for recovering keys from cryptographic signatures (aka signature verification) for transactions and blocks across multiple threads.
eos/libraries/chain/transaction_metadata.cpp:28

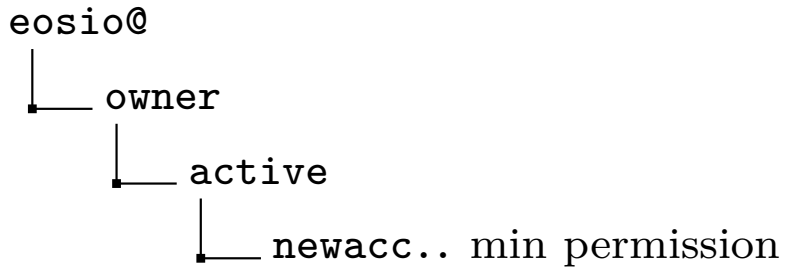
```
1  signing_keys_future_type transaction_metadata::start_recover_keys( const
    ↪   transaction_metadata_ptr& mtrx, boost::asio::thread_pool& thread_pool, const
    ↪   chain_id_type& chain_id, fc::microseconds time_limit )
2  {
3     if( mtrx->signing_keys_future.valid() && std::get<0>( mtrx->signing_keys_future.get() ) ==
       ↪   chain_id ) // already created
4        return mtrx->signing_keys_future;
5
6     std::weak_ptr<transaction_metadata> mtrx_wp = mtrx;
7     mtrx->signing_keys_future = async_thread_pool( thread_pool, [time_limit, chain_id, mtrx_wp]()
       ↪   {
8        fc::time_point deadline = time_limit == fc::microseconds::maximum() ?
9                                  fc::time_point::maximum() : fc::time_point::now() + time_limit;
10       auto mtrx = mtrx_wp.lock();
11       fc::microseconds cpu_usage;
12       flat_set<public_key_type> recovered_pub_keys;
13       if( mtrx ) {
14          const signed_transaction& trn = mtrx->packed_trx->get_signed_transaction();
15          cpu_usage = trn.get_signature_keys( chain_id, deadline, recovered_pub_keys );
16       }
17       return std::make_tuple( chain_id, cpu_usage, std::move( recovered_pub_keys ));
18    } );
19
20    return mtrx->signing_keys_future;
21 }
```

Permission Verification

eos/libraries/chain/authorization_manager.cpp:476 check_authorization()
eos/libraries/chain/include/eosio/chain/permission_object.hpp:51 satisfies()

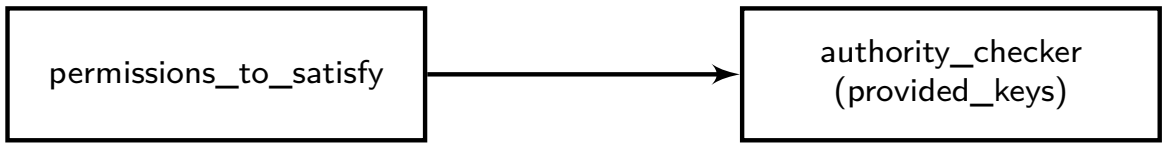
```
cleos set account permission eosio newacc '{"threshold":1,"keys":[{"key":"EOS6MRyAjQq8ud7hVNY
 ↪    cfnVPJqcVpscN5So8BhtHuGYqET5GDW5CV","weight":1}], "accounts":[],"waits":[]}' "active"
 ↪    -p eosio@active

cleos set action permission eosio eosio newaccount newacc -p eosio@active
```

```
{
  "actions":[
    {
      "account":"eosio",
      "name":"newaccount",
      "authorization":[
        {
          "actor":"eosio",
         "permission":"active"
        }
      ],
      "data":"..."
    }
  ]
}
```



Authorization Verification

eos/libraries/chain/authorization_manager.cpp:508 check_authorization()
eos/libraries/chain/include/eosio/chain/authority_checker.hpp:L60 authority_checker
eos/libraries/chain/include/eosio/chain/authority_checker.hpp:182 satisfied()
eos/libraries/chain/include/eosio/chain/authority_checker.hpp:206
weight_tally_visitor



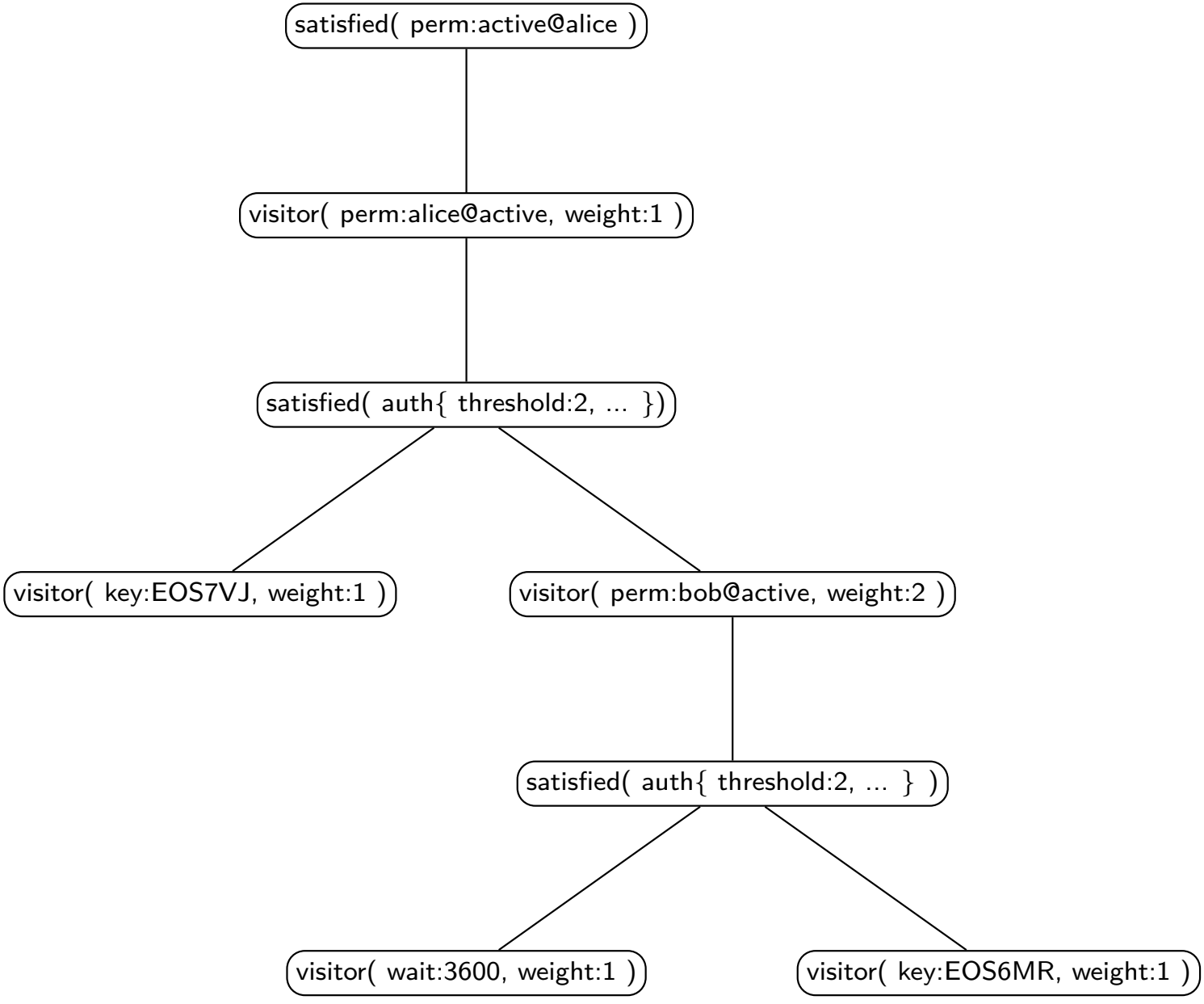
active@alice


```
{
  "threshold": 2,
  "keys": [
    {
      "key": "EOS7VJkEQhQw3JQNGhGwbX3oH3AEZE
       ↪    xia5cTZzSH1fm3y7HNVueck",
      "weight": 1
    }
  ],
  "accounts": [
    {
      "permission": {
        "actor": "bob",
        "permission": "active"
      },
      "weight": 2
    }
  ],
  "waits": []
}
```


active@bob


```
{
  "threshold": 2,
  "keys": [
    {
      "key": "EOS6MRyAjQq8ud7hVNYcfnVPJqcVps
       ↪    cN5So8BhtHuGYqET5GDW5CV",
      "weight": 1
    }
  ],
  "accounts": [],
  "waits": [
    {
      "wait_sec": "3600",
      "weight": 1
    }
  ]
}
```

Authorization Verification



Build & Debug

Build debug version nodeos.

```
./scripts/eosio_build.sh -o Debug
```

Run single node with gdb.

```
gdb ./build/programs/nodeos/nodeos

(gdb) run -e -p eosio --plugin eosio::chain_api_plugin --data-dir=data
```

`launch.json` for vscode: launch.json

References

https://developers.eos.io/eosio-cleos/docs/adding-eosiocode-to-active-authority-with-cleos-helper

https://developers.eos.io/eosio-nodeos/docs/accounts-and-permissions

https://medium.com/@eoscafeblock/how-permissions-work-in-eos-82e55eb1d896

https://medium.com/leclevietnam/understanding-eos-permission-ee60dcfec8ad

https://github.com/EOSIO/eos/tree/448287d520f5f8c282139ecc60f227c218d42e82

https://crypto.stackexchange.com/questions/18105/how-does-recovering-the-public-key-from-an-ecdsa-signature-work