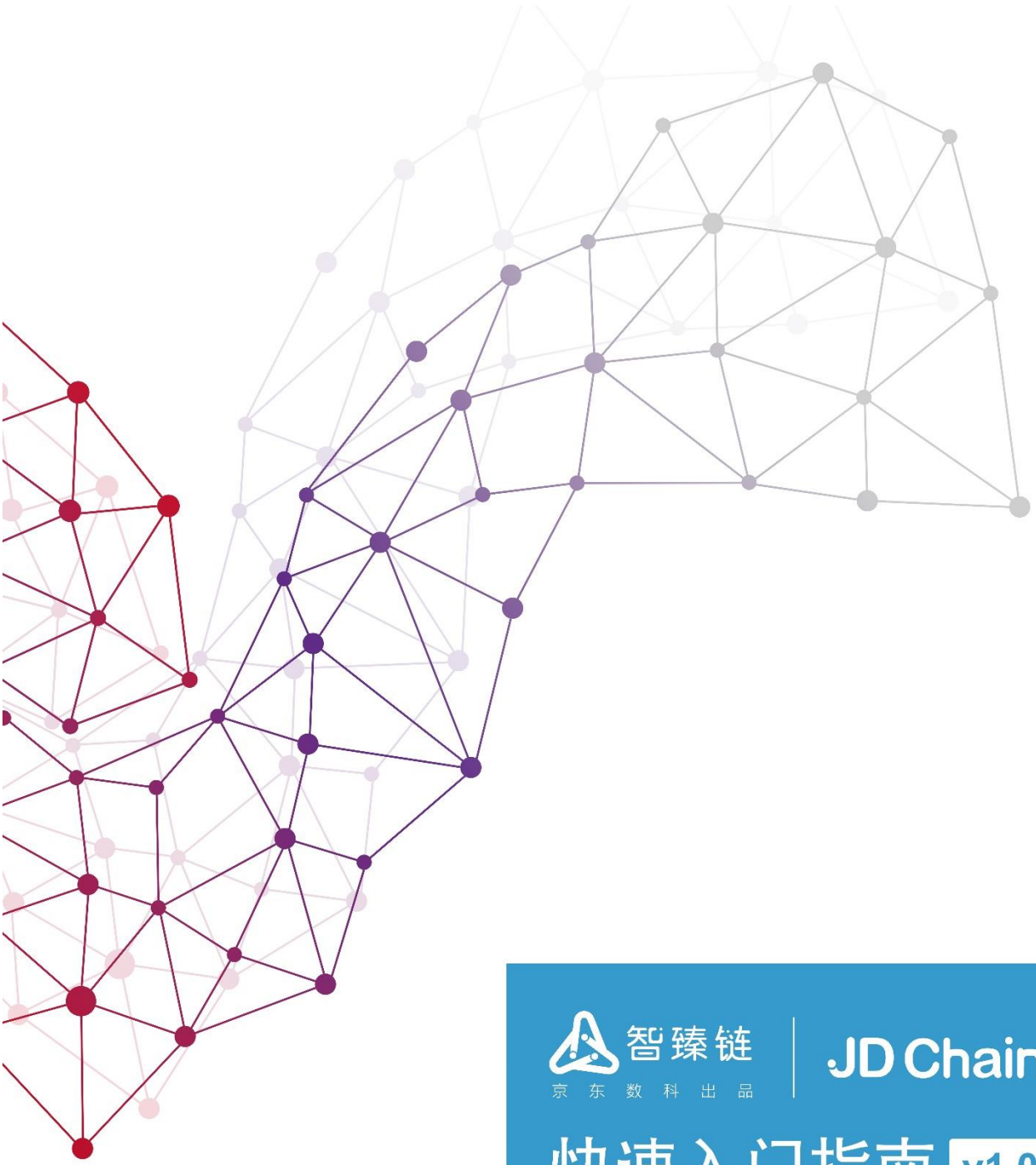


智臻链

京 东 数 科 出 品

JD Chain

快速入门指南 v1.0

2019.03

目 录

1 简介

本指南适用于已经成功构建基本开发环境，且希望快速进行智能合约开发的用户。

用户在 contract-compile 模块下，首先根据 com.jd.blockchain.contract 包下的合约样例，编写新合约。然后执行 mvn clean package 进行编译，在输出路径中找到对应的 xxx.jar 合约文件。再将此合约压缩包在测试链上部署并执行。

快速使用样例下载地址：https://github.com/blockchain-jd-com/jdchain-starter.git ，在此工程的 readme.txt 文件中也有相关说明。

1.1 准备

用户可直接通过 maven 中央库来获取 jar。

1.1.1 基于 SDK“数据快速上链”方式的 maven 坐标

```
<dependency>
        <groupId>com.jd.blockchain</groupId>
        <artifactId>sdk-client</artifactId>
        <version>0.8.2.RELEASE</version>
    </dependency>
```

1.1.2 基于“快速开发合约代码”方式的 maven 坐标

```
<dependency>
    <groupId>com.jd.blockchain</groupId>
    <artifactId>contract-model</artifactId>
    <version>0.8.2.RELEASE</version>
</dependency>
```

2 数据快速上链

2.1 服务连接

```
//创建服务代理
public static BlockchainKeyPair CLIENT_CERT = BlockchainKeyGenerator.getInstance().generate();
final String GATEWAY_IP = "127.0.0.1";
final int GATEWAY_PORT = 80;
final boolean SECURE = false;
GatewayServiceFactory serviceFactory = GatewayServiceFactory.connect(GATEWAY_IP,
GATEWAY_PORT, SECURE,
        CLIENT_CERT);
// 创建服务代理;
BlockchainService service = serviceFactory.getBlockchainService();
```

2.2 用户注册

```
// 创建服务代理;
    BlockchainService service = serviceFactory.getBlockchainService();
    // 在本地定义注册账号的 TX;
    TransactionTemplate txTemp = service.newTransaction(ledgerHash);
    SignatureFunction signatureFunction =
asymmetricCryptography.getSignatureFunction(CryptoAlgorithm.ED25519);
    CryptoKeyPair cryptoKeyPair = signatureFunction.generateKeyPair();
    BlockchainKeyPair user = new BlockchainKeyPair(cryptoKeyPair.getPubKey(),
cryptoKeyPair.getPrivKey());

    txTemp.users().register(user.getIdentity());

    // TX 准备就绪;
    PreparedTransaction prepTx = txTemp.prepare();
    // 使用私钥进行签名;
    CryptoKeyPair keyPair = getSponsorKey();
    prepTx.sign(keyPair);

    // 提交交易;
    prepTx.commit();
```

2.3 数据账户注册

```
    // 创建服务代理;
        BlockchainService service = serviceFactory.getBlockchainService();
        // 在本地定义注册账号的 TX;
        TransactionTemplate txTemp = service.newTransaction(ledgerHash);
        SignatureFunction signatureFunction =
asymmetricCryptography.getSignatureFunction(CryptoAlgorithm.ED25519);
        CryptoKeyPair cryptoKeyPair = signatureFunction.generateKeyPair();
        BlockchainKeyPair dataAccount = new BlockchainKeyPair(cryptoKeyPair.getPubKey(),
cryptoKeyPair.getPrivKey());

        txTemp.dataAccounts().register(dataAccount.getIdentity());

        // TX 准备就绪;
        PreparedTransaction prepTx = txTemp.prepare();
        // 使用私钥进行签名;
        CryptoKeyPair keyPair = getSponsorKey();
        prepTx.sign(keyPair);

        // 提交交易;
        prepTx.commit();
```

2.4 写入数据

```
    // 创建服务代理;
        BlockchainService service = serviceFactory.getBlockchainService();

        HashDigest ledgerHash = getLedgerHash();
        // 在本地定义注册账号的 TX;
        TransactionTemplate txTemp = service.newTransaction(ledgerHash);

        // ---------------------------------------
        // 将商品信息写入到指定的账户中;
        // 对象将被序列化为 JSON 形式存储，并基于 JSON 结构建立查询索引;
        String commodityDataAccount = "GGhhreGeasdfasfUUfehf9932lkae99ds66jf==";
        Commodity commodity1 = new Commodity();
        txTemp.dataAccount(commodityDataAccount).set("ASSET_CODE",
commodity1.getCode().getBytes(), -1);
    // TX 准备就绪;
        PreparedTransaction prepTx = txTemp.prepare();

        String txHash = ByteArray.toBase64(prepTx.getHash().toBytes());
        // 使用私钥进行签名;
        CryptoKeyPair keyPair = getSponsorKey();
        prepTx.sign(keyPair);

        // 提交交易;
        prepTx.commit();
```

2.5 查询数据

注：详细的查询可参考模块 sdk-samples 中 SDK_GateWay_Query_Test_相关测试用例

```
// 创建服务代理;
BlockchainService service = serviceFactory.getBlockchainService();

// 查询区块信息;
// 区块高度;
long ledgerNumber = service.getLedger(LEDGER_HASH).getLatestBlockHeight();
// 最新区块;
LedgerBlock latestBlock = service.getBlock(LEDGER_HASH, ledgerNumber);
// 区块中的交易的数量;
long txCount = service.getTransactionCount(LEDGER_HASH, latestBlock.getHash());
// 获取交易列表;
LedgerTransaction[] txList = service.getTransactions(LEDGER_HASH, ledgerNumber, 0, 100);
// 遍历交易列表
for (LedgerTransaction ledgerTransaction : txList) {
    TransactionContent txContent = ledgerTransaction.getTransactionContent();
    Operation[] operations = txContent.getOperations();
    if (operations != null && operations.length > 0) {
        for (Operation operation : operations) {
            operation = ClientOperationUtil.read(operation);
            // 操作类型：数据账户注册操作
            if (operation instanceof    DataAccountRegisterOperation) {
                DataAccountRegisterOperation daro = (DataAccountRegisterOperation) operation;
                BlockchainIdentity blockchainIdentity = daro.getAccountID();
            }
            // 操作类型：用户注册操作
            else if (operation instanceof UserRegisterOperation) {
                UserRegisterOperation uro = (UserRegisterOperation) operation;
                BlockchainIdentity blockchainIdentity = uro.getUserID();
            }
        // 操作类型：账本注册操作
            else if (operation instanceof LedgerInitOperation) {

                LedgerInitOperation ledgerInitOperation = (LedgerInitOperation)operation;
                LedgerInitSetting ledgerInitSetting = ledgerInitOperation.getInitSetting();

                ParticipantNode[] participantNodes = ledgerInitSetting.getConsensusParticipants();
            }
```

```
            // 操作类型：合约发布操作
            else if (operation instanceof ContractCodeDeployOperation) {
                ContractCodeDeployOperation ccdo = (ContractCodeDeployOperation) operation;
                BlockchainIdentity blockchainIdentity = ccdo.getContractID();
            }
            // 操作类型：合约执行操作
            else if (operation instanceof ContractEventSendOperation) {
                ContractEventSendOperation ceso = (ContractEventSendOperation) operation;
            }
            // 操作类型：KV 存储操作
            else if (operation instanceof DataAccountKVSetOperation) {
                DataAccountKVSetOperation.KVWriteEntry[] kvWriteEntries =
                        ((DataAccountKVSetOperation) operation).getWriteSet();
                if (kvWriteEntries != null && kvWriteEntries.length > 0) {
                    for (DataAccountKVSetOperation.KVWriteEntry kvWriteEntry : kvWriteEntries) {
                        BytesValue bytesValue = kvWriteEntry.getValue();
                        DataType dataType = bytesValue.getType();
                        Object showVal = ClientOperationUtil.readValueByBytesValue(bytesValue);
                        System.out.println("writeSet.key=" + kvWriteEntry.getKey());
                        System.out.println("writeSet.value=" + showVal);
                        System.out.println("writeSet.type=" + dataType);
                        System.out.println("writeSet.version=" + kvWriteEntry.getExpectedVersion());
                    }
                }
            }
        }
    }
}
    // 根据交易的 hash 获得交易；注：客户端生成 PrepareTransaction 时得到交易 hash;
     HashDigest txHash = txList[0].getTransactionContent().getHash();
    Transaction tx = service.getTransactionByContentHash(LEDGER_HASH, txHash);
```

```
// 获取数据;
String commerceAccount = "GGhhreGeasdfasfUUfehf9932lkae99ds66jf==";
String[] objKeys = new String[] { "x001", "x002" };
KVDataEntry[] kvData = service.getDataEntries(LEDGER_HASH, commerceAccount, objKeys);
long payloadVersion = kvData[0].getVersion();

// 获取数据账户下所有的 KV 列表
KVDataEntry[] kvData = service.getDataEntries(ledgerHash, commerceAccount, 0, 100);
if (kvData != null && kvData.length > 0) {
    for (KVDataEntry kvDatum : kvData) {
        System.out.println("kvData.key=" + kvDatum.getKey());
        System.out.println("kvData.version=" + kvDatum.getVersion());
        System.out.println("kvData.type=" + kvDatum.getType());
        System.out.println("kvData.value=" + kvDatum.getValue());
    }
}
```

2.6 合约发布

```
// 创建服务代理;
    BlockchainService service = serviceFactory.getBlockchainService();

    // 在本地定义 TX 模板
    TransactionTemplate txTemp = service.newTransaction(ledgerHash);
    // 合约内容读取
    byte[] contractBytes = FileUtils.readBytes(new File(CONTRACT_FILE));
    // 生成用户
    BlockchainIdentityData blockchainIdentity = new BlockchainIdentityData(getSponsorKey().getPubKey());

    // 发布合约
    txTemp.contracts().deploy(blockchainIdentity, contractBytes);

    // TX 准备就绪;
    PreparedTransaction prepTx = txTemp.prepare();

    // 使用私钥进行签名;
    CryptoKeyPair keyPair = getSponsorKey();
    prepTx.sign(keyPair);
    // 提交交易;
    TransactionResponse transactionResponse = prepTx.commit();
    assertTrue(transactionResponse.isSuccess());
    // 打印合约地址
    System.out.println(blockchainIdentity.getAddress().toBase58());
```

2.7 合约执行

```
// 创建服务代理;
    BlockchainService service = serviceFactory.getBlockchainService();

    // 在本地定义 TX 模板
    TransactionTemplate txTemp = service.newTransaction(ledgerHash);

    // 合约地址
    String contractAddressBase58 = "";

    // Event
    String event = "";
    // args（注意参数的格式）
    byte[] args = "20##30##abc".getBytes();

    // 提交合约执行代码
    txTemp.contractEvents().send(contractAddressBase58, event, args);
    // TX 准备就绪;
    PreparedTransaction prepTx = txTemp.prepare();
    // 生成私钥并使用私钥进行签名;
    CryptoKeyPair keyPair = getSponsorKey();
    prepTx.sign(keyPair);
    // 提交交易;
    TransactionResponse transactionResponse = prepTx.commit();
    assertTrue(transactionResponse.isSuccess());
```

3 快速开发合约代码

3.1 开发

入门样例可参照：com.jd.blockchain.contract.AssetContract3，合约类实现 EventProcessingAwire 接口，同时在合约的入口方法上添加注解：@ContractEvent(name = "xxx")，形参为：ContractEventContext eventContext。

格式如下：

```
public class AssetContract3 implements EventProcessingAwire{
@ContractEvent(name = "xxx")
public void test1(ContractEventContext eventContext){
}
}
```

合约中可以通过 ContractEventContext 对象来调用账本中的相关方法，例如：

```
BlockchainAccount holderAccount = eventContext.getLedger().getAccount(currentLedgerHash(), assetHolderAddress);
```

3.2 编译

编译工作在 contract-compile 工程中进行。在控制台中执行：

```
mvn clean package
```

来直接编译生成所需的合约压缩包。

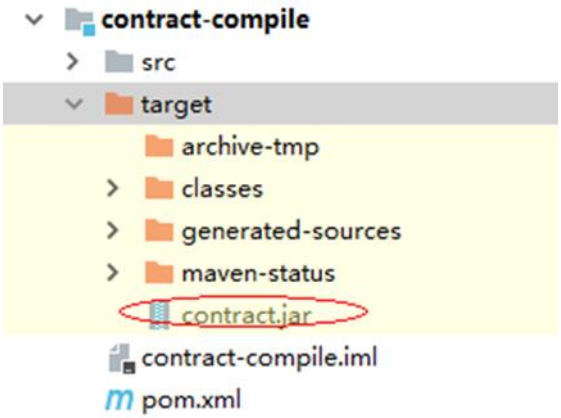
注意修改 pom.xml 文件中<filename>和<mainClass>这两个属性：

```
<plugin>
    <artifactId>maven-assembly-plugin</artifactId>
    <configuration>
        <finalName>contract</finalName>
        <appendAssemblyId>false</appendAssemblyId>
        <archive>
            <manifest>
                <mainClass>com.jd.blockchain.contract.AssetContract4</mainClass>
            </manifest>
```

```
            </archive>
            <descriptorRefs>
                <descriptorRef>jar-with-dependencies</descriptorRef>
            </descriptorRefs>
        </configuration>
        <executions>
            <execution>
                <id>make-assembly</id>
                <phase>package</phase>
                <goals>
                    <goal>single</goal>
                </goals>
            </execution>
        </executions>
    </plugin>
```

3.3 发布

编译完成之后，根据如上的配置，会在 target 目录下生成对应的合约压缩文件：contract.jar。



3.3.1 sys-contract.properties

```
#常规使用;
ownerPubPath=xxx/conf/jd-com.pub
ownerPrvPath=xxx/conf/jd-com.priv
ownerPassword=xxx/conf/ownerPassword.txt
ledgerHash=6Gw3cK4uazegy4HjoaM81ck9NgYLNoKyBMb7a1TK1jt3d

host=192.168.151.45
port=8081
#合约使用如下;
event = issue-asset
chainCodePath=xxx/AssetContract3.contract
contractArgs=10##4##abc
```

3.3.2 发布与执行方法

运行 IntegrationTest.java 中的如下方法来发布和执行合约：

```
one_deploy_exe_contract_on_test_gateway()
```

具体代码如下：

```
    /**
     * 在测试链上仅发布和执行合约;
     */
    private void deploy_exe_contract_on_test_gateway(){
        //then exe the contract;
        //由于合约发布之后需要后台进行共识处理，需要一定的时间消耗，先休息 5 秒钟之后再执行;
        try {
            Thread.sleep(1000L);
            boolean deployResult = ContractDeployExeUtil.instance.deploy(host, port,
ledger,ownerPubPath, ownerPrvPath, ownerPassword, chainCodePath,contractPub);
            System.out.println("deployResult="+deployResult);
            Thread.sleep(2000L);
            boolean exeResult = false;
            exeResult = ContractDeployExeUtil.instance.exeContract(ledger,ownerPubPath, ownerPrvPath,
ownerPassword,eventName,contractArgs);
            System.out.println("execute the contract,result= "+exeResult);
        } catch (InterruptedException e) {
            e.printStackTrace();
        }
    }
```

```
    // 发布完成之后，会在控制台中生成如下信息:
    contract's address=5SmDBPXfXoSsJmfJskkpeVbZkxfkawqWE9CE
    deployResult=true
```

3.4 执行

执行即如上的方法:

```
ContractDeployExeUtil.instance.exeContract(ledger,ownerPubPath, ownerPrvPath,
ownerPassword,eventName,contractArgs);
```

在执行完成之后，可以在 API 接口中查询相关的信息。

3.4.1 根据合约地址查询

访问格式如下:

http://192.168.151.45:7080/ledgers/6Gw3cK4uazegy4HjoaM81ck9NgYLNoKyBMb7a1TK1jt3d/contracts/5SmDBPXfXoSsJmfJskkpeVbZkxfkawqWE9CE

结果：


```
{
"data": {
"address": "5SmDBPXfXoSsJmfJskkpeVbZkxfkawqWE9CE",
"chainCode":
"UEsDBBQACAgIAACAlE0AAAAAAAAAAAAAAAAJAAQATUVUQS1JTkYv/soAAAMAUEsHCAAAAAAC
AAAAAAAAAAFBLAwQUAAgICAAAgJRNAAAAAAAAAAAAAAAAFAAAAE1FVEEtSU5GL01BTklGRVNU
Lk1G803My0xLLS7RDUstKs7Mz7NSMNQz4OVyLkpNLElN0XWqBAlY6BnEG5qYKGj4FyUm56QqOOcXFeQ
XJZYA1WvycvFyAQBQSwcInnx2U0QAAABFAAAAUEsDBBQACAgIAACAlE0AAAAAAAAAAAAAAAATA
AAAY29udHJhY3QucHJvcGVydGllc1OOKTU1MbCIKTV3dTQDkmZuQLapobkxkHQ2dY0pNTMwMuflUg7JKF
VwSU1WMDJQMDSzMjCwMjBUcA4OAfINLXi5kvPzSooSk0tsk/Nz9bJS9JJy8pOzkzMSM/P0YFJ6jsXFqSXOUJ
4xLxcAUEsHCBckArNrAAAAegAAAFBLAQIUABQACAgIAACAlE0AAAAAAgAAAAAAAAAJAAQAAAAA
AAAAAAAAAAAAAAABNRVRBLUlORi/+ygAAUEsBAhQAFAAICAgAAICUTZ58dlNEAAAARQAAABQAA
AAAAAAAAAAAAAAAAPQAAAE1FVEEtSU5GL01BTklGRVNULk1GUEsBAhQAFAAICAgAAICUTRckArNr
AAAAegAAABMAAAAAAAAAAAAAAAAAAwwAAAGNvbnRyYWN0LnByb3BlcnRpZXNQSwUGAAAAAA
MAAwC+AAAAbwEAAAAA",
"chaincodeProof": {
"dataHash": {
"value": "6LwUAHD8zZbANkdJL8bBHpYM2BYduZpQXzaV5T92XxyLL"
},
"dataNode": {
"key": "CHAIN-CODE",
"level": 0,
"nodeHash": {
"value": "6LwUAHD8zZbANkdJL8bBHpYM2BYduZpQXzaV5T92XxyLL"
},
"sN": 0,
"version": 0
},
"levels": 1,
"rootHash": {
"value": "65WEJwZWpdpv5A8BWDqsJQxW33qBR16q4Bx8tzUTbSUWv"
},
"sN": 0
},
"chaincodeVersion": 0,
"pubKey": {
"value": "mayaPm1C7opEhSyRtmH7rkbmxAX2MvrzUguFkgcJ7mpfQY"
},
"rootHash": {
"value": "65WEJwZWpdpv5A8BWDqsJQxW33qBR16q4Bx8tzUTbSUWv"
}
},
```