



## Tutorial A6: Upgrading a smart contract

Estimated time: 20 minutes

**Note:** This tutorial is based on Hyperledger Fabric v1.x. There is a new chaincode lifecycle feature in v2 that improves the upgrade process. Check out the [Hyperledger Fabric v2.0 chaincode documentation](#) for details.

In the previous tutorial, we built and tested a TypeScript application that interacted with a Hyperledger Fabric network. In this tutorial we will:

- Make a change to a smart contract
- Package and deploy a new version of the new smart contract
- Try out the new smart contract

In order to successfully complete this tutorial, you must have first completed [tutorial A5: Invoking a smart contract from an external application](#) in the active workspace.

**A6.1:** Expand the first section below to get started.

### ► Modify the smart contract

**A6.2:** Focus the VS Code editor on the *my-asset-contract.ts* file.

You should be able to switch directly to this tab as it should still be loaded from earlier tutorials. If it is not, use the Explorer side bar to navigate to *my-asset-contract.ts* in the *src* folder of the *demo-contract* project.

```
EXPLORER
  > OPEN EDITORS
  > UNTITLED (WORKSPACE)
  > demo-contract
    > .vscode
    > dist
    > node_modules
    > src
      TS index.ts
      TS my-asset-contract.spec.ts
      TS my-asset-contract.ts
      TS my-asset.ts
    > transaction_data
    .editorconfig
    .gitignore

  TS invoke.ts
  TS my-asset-contract... X
  tsconfig.json
  package.json

demo-contract > src > TS my-asset-contract.ts > ...
1  /*
2   * SPDX-License-Identifier: Apache-2.0
3   */
4
5  import { Context, Contract, Info, Returns, Transaction } from 'hyperledger-fabric';
6  import { MyAsset } from './my-asset';
7
8  @Info({title: 'MyAssetContract', description: 'My Smart Contract'})
9  export class MyAssetContract extends Contract {
10
11    @Transaction(false)
12    @Returns('boolean')
13    public async myAssetExists(ctx: Context, myAssetId: string): Promise<boolean> {
14      const buffer = await ctx.stub.getState(myAssetId);
15      return (!!buffer && buffer.length > 0);
16    }
17  }
```

We're going to add a new method to our smart contract which will return all of the available assets with an identifier between '000' and '999'.

A smart contract package has a version, and as smart contracts within a package evolve, the version number of the package should be incremented to reflect this change. So far, we've been working with version 0.0.1 of the demo-contract package.

We're going to learn about the smart contract package upgrade process as we enhance the MyAsset smart contract within the package. We are going to increment the package version to reflect this change.

### Smart contract evolution

Because the transactions created by a smart contract live forever on the blockchain, when a package is re-versioned, all the previously created states persist unchanged, and accessible by the new package. It means that a smart contract needs to maintain data compatibility between version boundaries as it will be working with state data created in all previous versions.

Practically speaking, it makes sense to use extensible data structures where possible, and to have sensible defaults when values are missing.

Our new transaction will not modify any data structures, so we do not need to consider cross-version compatibility.

**A6.3:** Using copy and paste, insert the following method after the closing brace of the `deleteMyAsset` method, but before the final closing brace of the whole file:

```
@Transaction(false)
public async queryAllAssets(ctx: Context): Promise<string> {
  const startKey = '000';
  const endKey = '999';
  const iterator = await ctx.stub.getStateByRange(startKey, endKey);
  const allResults = [];
  while (true) {
    const res = await iterator.next();
    if (res.value && res.value.value.toString()) {
      console.log(res.value.value.toString('utf8'));

      const Key = res.value.key;
      let Record;
      try {
        Record = JSON.parse(res.value.value.toString('utf8'));
      } catch (err) {
        console.log(err);
        Record = res.value.value.toString('utf8');
      }
      allResults.push({ Key, Record });
    }
    if (res.done) {
      console.log('end of data');
      await iterator.close();
      console.info(allResults);
    }
  }
}
```

```

        return JSON.stringify(allResults);
    }
}
}

```

You can also get the source for this method from [here](#).

Your source file should now look similar to this:

```

59     }
60     await ctx.stub.deleteState(myAssetId);
61 }
62
63 @Transaction(false)
64 public async queryAllAssets(ctx: Context): Promise<string> {
65     const startKey = '000';
66     const endKey = '999';
67     const iterator = await ctx.stub.getStateByRange(startKey, endKey);
68     const allResults = [];
69     while (true) {
70         const res = await iterator.next();
71         if (res.value && res.value.value.toString()) {
72             console.log(res.value.value.toString('utf8'));
73
74             const Key = res.value.key;
75             let Record;
76             try {
77                 Record = JSON.parse(res.value.value.toString('utf8'));
78             } catch (err) {
79                 console.log(err);
80                 Record = res.value.value.toString('utf8');
81             }
82             allResults.push({ Key, Record });
83         }
84         if (res.done) {
85             console.log('end of data');
86             await iterator.close();
87             console.info(allResults);
88             return JSON.stringify(allResults);
89         }
90     }
91 }
92
93

```

**A6.4:** Save the updated file ('File' -> 'Save').

There should be no compilation errors.

Before we can package our new smart contract, we need to update the package version number. In a production environment, an automated process would typically do this, but we will update the necessary file manually.

### Updating smart contract package versions is mandatory

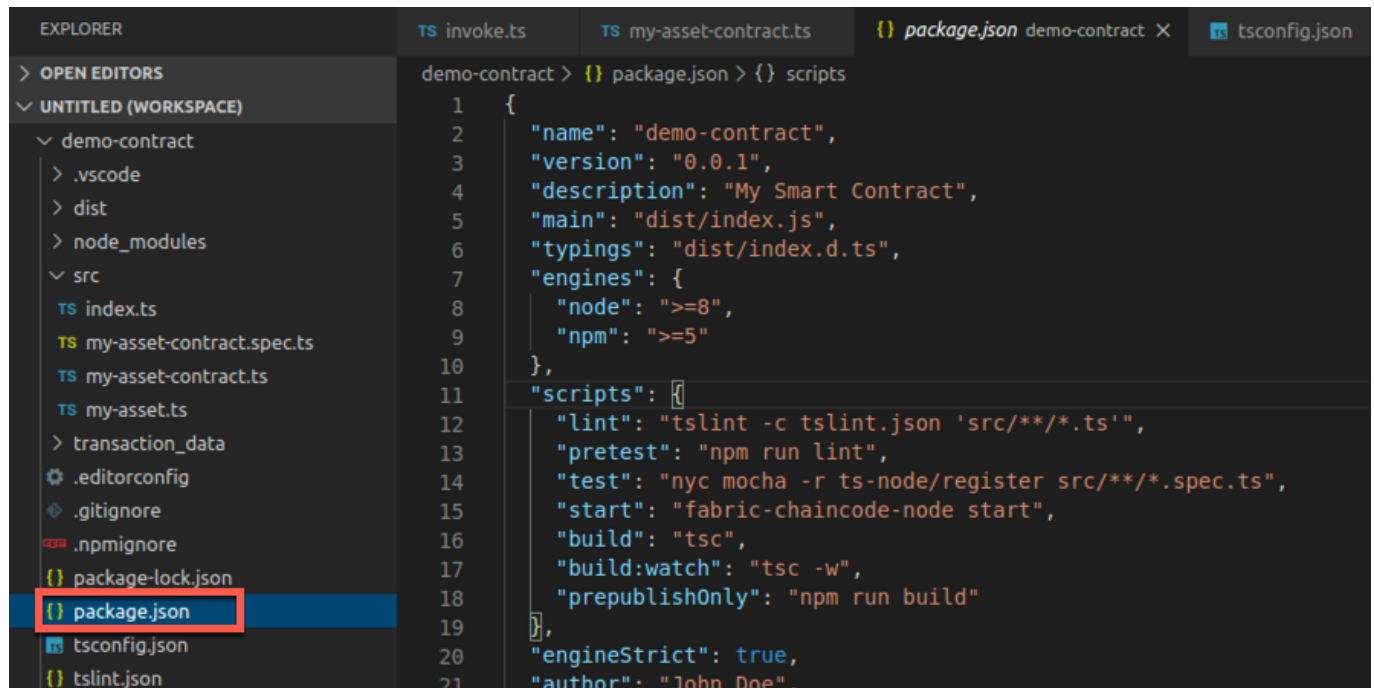
The IBM Blockchain Platform VS Code extension uses the version number in package.json to create the smart contract package with a unique name. It further uses the version number as the suggested default when deploying the package to the peer. The default value can be changed at deploy time, but note that

Hyperledger Fabric requires that unique version numbers are used as part of the smart contract lifecycle.

- A6.5: Switch to the editor for the demo-contract *package.json* file.

Again, this should be already loaded from earlier tutorials. If not, use the Explorer side bar to navigate to *package.json* in the root of the demo-contract project.

Take care to load the *demo-contract* copy of the file; you will recall that we created another *package.json* for *demo-application*.



The screenshot shows the VS Code interface. On the left, the Explorer sidebar displays the file structure of the 'demo-contract' project. The 'package.json' file is highlighted with a red rectangle. The main editor area shows the content of 'package.json' for the 'demo-contract' workspace. The file contains the following JSON:

```
1 {
2   "name": "demo-contract",
3   "version": "0.0.1",
4   "description": "My Smart Contract",
5   "main": "dist/index.js",
6   "typings": "dist/index.d.ts",
7   "engines": {
8     "node": ">=8",
9     "npm": ">=5"
10  },
11  "scripts": {
12    "lint": "tslint -c tslint.json 'src/**/*.ts'",
13    "pretest": "npm run lint",
14    "test": "nyc mocha -r ts-node/register src/**/*.spec.ts",
15    "start": "fabric-chaincode-node start",
16    "build": "tsc",
17    "build:watch": "tsc -w",
18    "prepublishOnly": "npm run build"
19  },
20  "engineStrict": true,
21  "author": "John Doe",
22 }
```

- A6.6: Edit the value of the version tag to "0.0.2".



The screenshot shows the VS Code editor with the 'package.json' file open. The 'version' field is highlighted with a red rectangle, and its value is being changed from '0.0.1' to '0.0.2'. The JSON content is as follows:

```
1 {
2   "name": "demo-contract",
3   "version": "0.0.2",
4   "description": "My Smart Contract",
5   "main": "dist/index.js",
6   "typings": "dist/index.d.ts",
7   "engines": {
8     "node": ">=8",
9     "npm": ">=5"
10  },
11  "scripts": {
```

- A6.7: Save the changes ('File' -> 'Save').

In the next section we will deploy the new smart contract to our peer.

- A6.8: Expand the next section of the tutorial to continue.

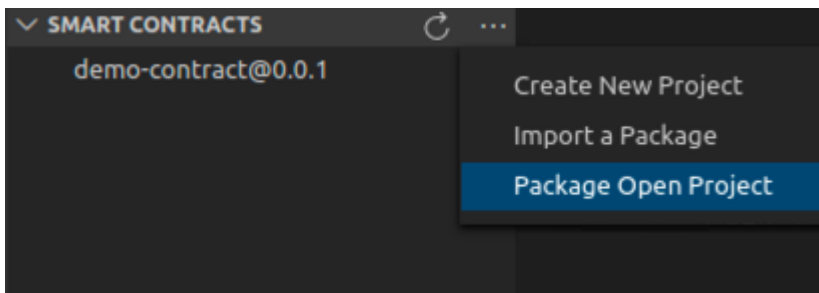
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## ► Deploy the upgraded smart contract

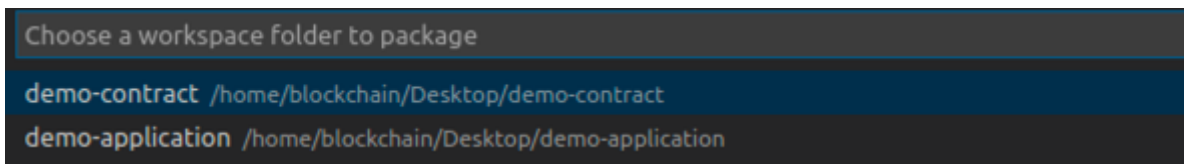
In this section we will package the smart contract and deploy it to the peer. The upgrade process is the same as the initial deploy process from tutorial [A3: Deploying a smart contract](#).

## Package the smart contract

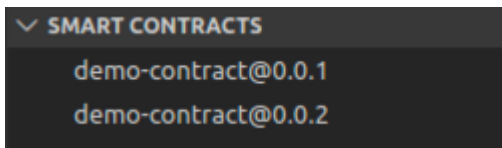
- **A6.9:** Click the IBM Blockchain Platform activity bar icon to show the IBM Blockchain Platform side bar.
- **A6.10:** Hover the mouse over the Smart Contracts view, click '...' and select 'Package Open Project'.



- **A6.11:** Select 'demo-contract'.



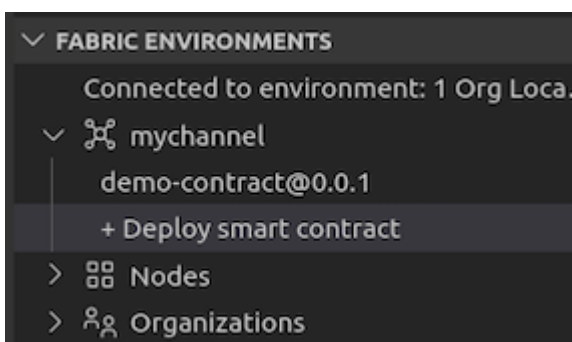
After a brief pause while the packaging completes, the newer version of demo-contract will be shown in the Smart Contracts view underneath the older one:



## Deploy the smart contract

- **A6.12:** In the Fabric Environments view, expand "mychannel" and click "+ Deploy smart contract".

The local Fabric environment needs to be running in order to do this. If it is stopped for any reason, you will need to first click the '1 Org Local Fabric' environment in the Fabric Environments view to start it.



- A6.13: In the Deploy Smart Contract form, select "demo-contract@0.0.2" from the drop down list, and click 'Next'.

The screenshot shows the 'Deploy smart contract' form at Step 1, 'Choose smart contract'. The title 'Deploy smart contract' is at the top left, and a blue 'Next' button is at the top right. Below the title, it says 'Deploying to mychannel in 1 Org Local Fabric'. A progress bar shows Step 1 as the active step, with Step 2 'Create definition' and Step 3 'Deploy' as options. The main instruction is 'Choose a smart contract to deploy'. A dropdown menu is open, showing a list of smart contracts: 'demo-application (open project)', 'demo-contract (open project)', 'demo-contract@0.0.1 (packaged)', and 'demo-contract@0.0.2 (packaged)'. The last option is highlighted.

- A6.14: In step 2 of the form, default values for Definition name and version of the updated contract are provided, click 'Next' to move to Step 3 of the deploy.

The screenshot shows the 'Deploy smart contract' form at Step 2, 'Create definition'. The title 'Deploy smart contract' is at the top left, and 'Back' and 'Next' buttons are at the top right. Below the title, it says 'Deploying to mychannel in 1 Org Local Fabric'. A progress bar shows Step 1 as completed, Step 2 as the active step, and Step 3 'Deploy' as an option. The main instruction is 'A smart contract definition describes how the selected package will be deployed in this channel. The package's name and version (where available) are copied across to the definition as defaults. You may optionally change them.' Below this, there is a section titled 'Smart contract definition' with two input fields: 'Definition name' with the value 'demo-contract' and 'Definition version' with the value '0.0.2'. At the bottom, there is a light blue information box with an 'i' icon, stating: 'Name matches an existing smart contract. We recommend changing the definition version to update the existing smart contract, or provide a new name to deploy as a new definition.'

- A6.15: In step 3 of the form, the automated steps of the deploy are summarized, click 'Deploy' to start the deployment.

## Deploy smart contract

BackDeploy

Deploying to mychannel in 1 Org Local Fabric

✓ Step 1  
Choose smart contract

✓ Step 2  
Create definition

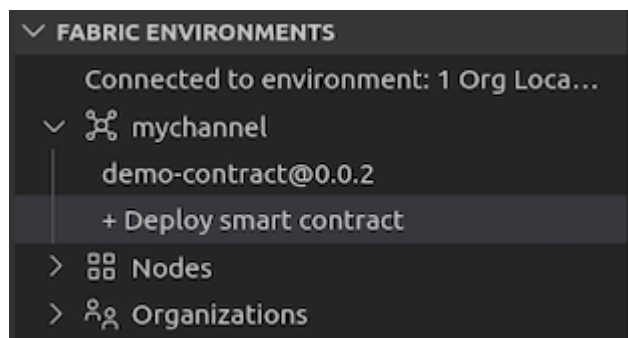
● Step 3  
Deploy

When you select 'Deploy', the following actions will automatically occur:

- Install smart contract package `'demo-contract@0.0.2'` on all peers
- Approve the same smart contract definition for each organization
- Commit the definition to `'mychannel'`

Deployment of the upgraded contract may take a few minutes to complete.

When the deployment is complete the upgraded version of the smart contract will be displayed in the Fabric Environments view under mychannel.



**A6.16:** Expand the next section of the tutorial to continue.

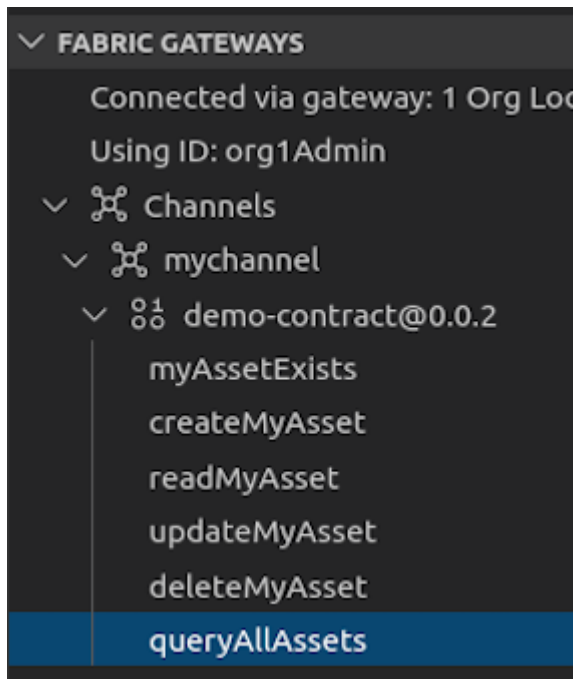
### ► Try out the upgraded smart contract

Finally in this tutorial we will try out the new *queryAllAssets* method to make sure it works. We will do this using the Fabric Gateways view.

**A6.17:** In the connected Fabric Gateways view, expand 'Channels' -> 'mychannel' -> 'demo-contract@0.0.2'.

You will see the new *queryAllAssets* transaction listed among the others.





If you have completed all the previous steps in this set of tutorials, your blockchain world state will only contain one asset at this point ('002'), as we deleted asset '001' at the end of tutorial A4: [Invoking a smart contract from VS Code](#).

Therefore, to prove that we can return multiple values from our new transaction, we will first create a new asset '003'.

**A6.18:** Right-click the *createMyAsset* transaction and select 'Submit Transaction'. Create an asset with the input parameters `["003", "The Scream"]`. There is no transient data.

With the new asset created, we will now try out the *queryAllAssets* transaction. It is a read-only transaction and so we can invoke it using the *evaluate* option.

**A6.19:** Right-click the *queryAllAssets* transaction and select 'Evaluate Transaction'. Press Enter twice to select the defaults for both the input parameters (there are none) and transient data.

You will see the results of the transaction displayed in the Output view; particularly, records for asset '002' and '003'. (Close the "Successfully submitted transaction" notifications if the output is obscured.)

```
DEBUG CONSOLE  PROBLEMS  OUTPUT  TERMINAL  Blockchain
[4/24/2020 3:29:45 PM] [SUCCESS] Returned value from queryAllAssets: [{"Key":"002","Record":{"value":"Night Watch"}}]
[4/24/2020 3:30:07 PM] [INFO] submitTransaction
[4/24/2020 3:30:18 PM] [INFO] submitting transaction createMyAsset with args 003,The Scream on channel mychannel
[4/24/2020 3:30:20 PM] [SUCCESS] No value returned from createMyAsset
[4/24/2020 3:30:24 PM] [INFO] evaluateTransaction
[4/24/2020 3:30:26 PM] [INFO] evaluating transaction queryAllAssets with no args on channel mychannel
[4/24/2020 3:30:26 PM] [SUCCESS] Returned value from queryAllAssets: [{"Key":"002","Record":{"value":"Night Watch"}}, {"Key":"003","Record":{"value":"The Scream"}}]
```

Congratulations, you queried all the assets on the ledger!

## Summary



In this tutorial, we looked at the smart contract upgrade process in Hyperledger Fabric v1.x. We started by making a change to our existing smart contract, then we packaged it and deployed the new version of it. We then tried it out.

In the next tutorial, we will look at some features in the IBM Blockchain Platform VS Code extension that makes the debugging of smart contracts easier.

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→ **Next: A7: Debugging a smart contract**