

# IBM Blockchain

An introduction with hands-on labs

<https://ibm.biz/BdsX6v>

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# Blockchain agenda

1. Double-entry bookkeeping and the business background to the Blockchain
2. The Hyperledger Project
3. Blockchain concepts and terminology
4. Hands-on Blockchain hands-on labs
5. Where do we go from here?

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# **Section 1:**

## **Double-entry bookkeeping and the business background to the Blockchain**

# Double-entry bookkeeping and the role of business ledgers

## LEDGER

ACCOUNT TYPE		CASH			
TRANSACTION DATE	TRANSACTION DETAIL	REFERENCE	DEBIT	CREDIT	BALANCE
1/1/16	Expenses for Jan	Ref#1	\$100.00		\$100.00
2/1/16	Tax withheld	Ref#2		\$110.00	(\$10.00)

Luca Bartolomeo de Pacioli



*Portrait of Luca Pacioli*, traditionally attributed to *Jacopo de' Barbari*, 1495 (attribution controversial).<sup>[1]</sup>

- Business transactions **typically involve various participants like buyers, sellers, and intermediaries** (such as banks, auditors, or notaries) whose business agreements and contracts are recorded in ***business ledgers***.
- **A business typically uses multiple ledgers** to keep track of asset ownership and asset transfers between participants in its various lines of businesses.
- Ledgers are the systems of record (SORs) for a business's economic activities and interests.

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# Problems with current business ledgers

Current business ledgers in use today are deficient in many ways:

- They are **inefficient, costly, non-transparent, and subject to fraud** and misuse.
- **These problems stem from centralized, trust-based, third-party systems,**
- Having to **resolve disputes and possibly reverse transactions or provide Insurance for transactions is costly.**

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## Lets look at some of the problems that Blockchain can solve

<https://www.youtube.com/watch?v=IgNfoQQ5Reg> IBM Blockchain Car Lease Demo

<https://www.youtube.com/watch?v=F0P7NM7d-ps> Blockchain in IBM Global Financing

<https://www.youtube.com/watch?v=TZjs-BYiE5I&feature=youtu.be> Blockchain on IBM z Systems for Finance

<https://www.youtube.com/watch?v=r0LsnzAe1Yg> International Trade Solution on Blockchain

<https://www.youtube.com/watch?v=B2eYh2Y7rJw&feature=youtu.be> Trading Commerical Paper via blockchain with IBM Bluemix

# Blockchain and the Internet of Things in international trade

## Overview

Our interactive demo tracks the shipment of a package as it moves along the supply chain, passing through multiple carriers. It shows how an IoT-enabled package transmits required status information along the way and how each transaction is tracked and shared among all partners in a blockchain.

Play



<https://www.ibm.com/internet-of-things/iot-news/announcements/private-blockchain/>

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## And then came Bitcoin and Blockchain



- Bitcoin is a cryptocurrency and a payment system
- invented by an unidentified programmer, or group of programmers, under the name of Satoshi Nakamoto.
- Bitcoin was introduced on 31 October 2008 to a cryptography mailing list, and released as open-source software in 2009.
- The system is peer-to-peer and transactions take place between users directly, without an intermediary.
- **These transactions are verified by network nodes and recorded in a public distributed ledger called the blockchain**, which uses bitcoin as its unit of account.

<https://en.wikipedia.org/wiki/Bitcoin>



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## **Section 2:**

# **The Hyperledger project**

# The Hyperledger project

<https://www.hyperledger.org/>



The image shows a screenshot of the Hyperledger Project's Twitter profile. The header features the Hyperledger logo, a stylized network of nodes and lines, and the text "HYPERLEDGER PROJECT". Below the header, a bio states: "The Hyperledger Project is an open source, industry-wide project that brings together future and existing open source blockchain technology. Governed by The Linux Foundation, the project is building a general-purpose blockchain framework that can be used across industry sectors, from financial services to retail to manufacturing and more." A link to "hyperledger.org" is provided. The profile statistics show 1,511 tweets, 3,133 following, 7,262 followers, 273 likes, and 4 lists. A "Follow" button is visible. The profile bio also includes the location "San Francisco, CA", the website "hyperledger.org", and the date "Joined May 2014". A tweet is visible, mentioning "Australia reveals plans for Blockchain in public services" and linking to "govinsider.asia".

**Hyperledger Project**  
@Hyperledger

An industry-wide open source project to advance blockchain technology and governed by The Linux Foundation.

San Francisco, CA  
[hyperledger.org](https://hyperledger.org)  
Joined May 2014

**Hyperledger Project** @Hyperledger · 55m  
Australia reveals plans for Blockchain in public services

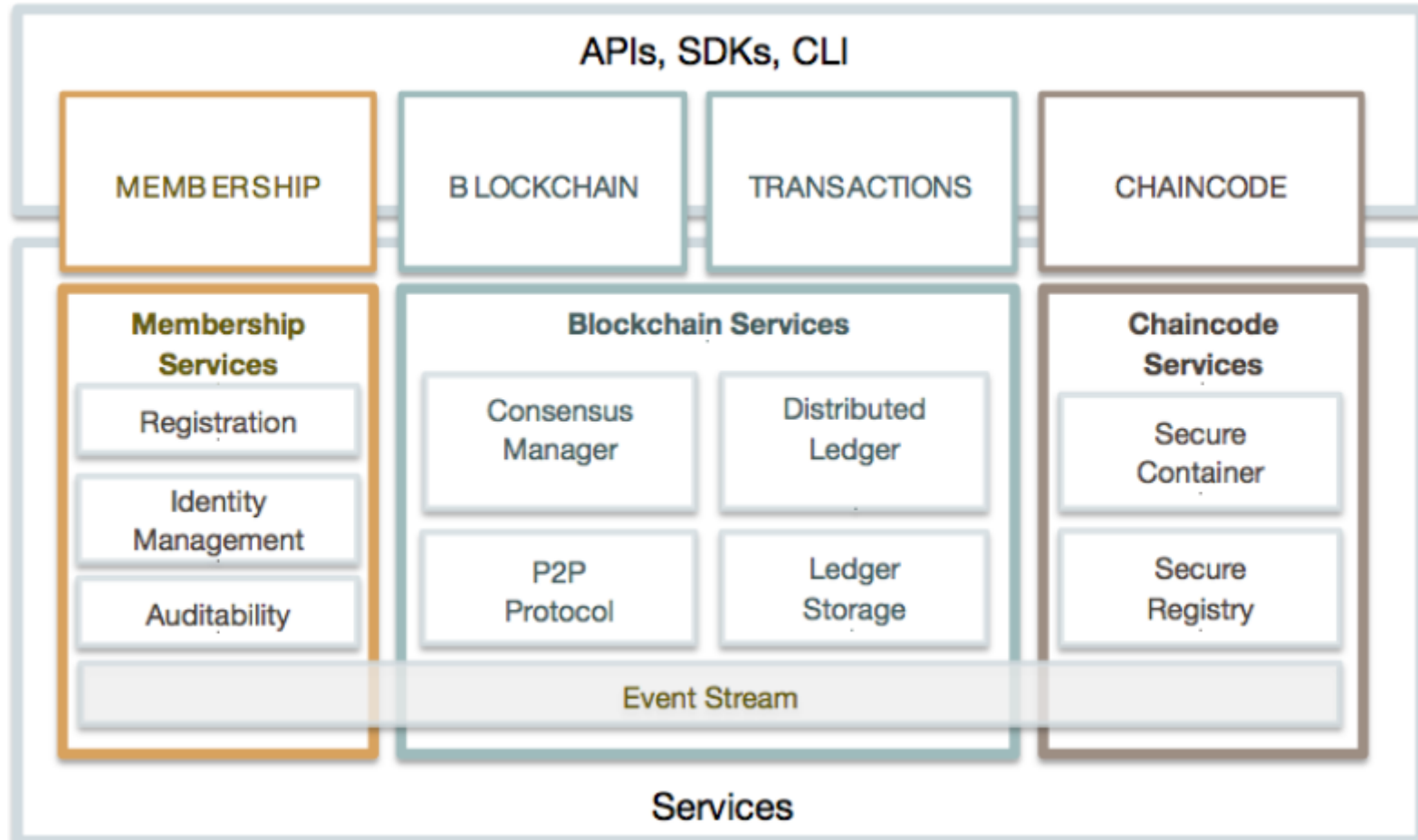
**Exclusive: Australia reveals plans for Blockchain in...**  
Foresight unit discusses potential in police, food security, and government communications.  
[govinsider.asia](https://govinsider.asia)

<https://github.com/hyperledger>

<https://twitter.com/Hyperledger>

<https://www.youtube.com/watch?v=EKa5Gh9whgU> Building a Blockchain for business with the Hyperledger Project

# The Hyperledger project



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# The Hyperledger project

- **A cross-industry collaborative effort, started in December 2015** by the Linux Foundation to support blockchain-based distributed ledgers
- It is focused on **ledgers designed to support global business transactions, including major technological, financial, and supply chain companies**, with the goal of improving many aspects of performance and reliability.
- The project aims to bring together a number of independent efforts to **develop open protocols and standards, by providing a modular framework that supports different components for different uses**. This would include a variety of blockchains with their own consensus and storage models, and services for identity, access control, and contracts.

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# The Hyperledger project

The Hyperledger Project defined a protocol specification known as **Open Blockchain Protocol Specification** to create a blockchain fabric for use in a variety of industry use-cases involving B2B and B2C transactions. The primary goals of this effort are:

- Support a wide variety of industrial use cases with different requirements
- Comply with regulatory regimes that exist today
- Support
  - verified identities, private and confidential transactions
  - permissioned, shared ledger
  - performance, scaling, auditability, identity, security, and privacy
  - reduction of costly computations involved in proof of work

Hyperledger's Blockchain fabric use the following concepts as its underpinnings:

- Smart contracts
- Digital assets
- System of record repositories/stores
- Decentralized consensus-based network
- Pluggable consensus algorithms/models
- Cryptographic security

<https://github.com/OpenAssets/open-assets-protocol>

# The Hyperledger project

## FINANCE

Hyperledger and its members are active defining financial services use cases and pursuing various finance PoCs.

LEARN MORE



## HEALTHCARE

Hyperledger is committed to helping the healthcare industry realize the full potential of open source blockchain technologies.

LEARN MORE



## SUPPLY CHAIN

*Coming Soon*

LEARN MORE



<https://www.hyperledger.org/industries>

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## **Section 3: Blockchain Concepts and Technologies**

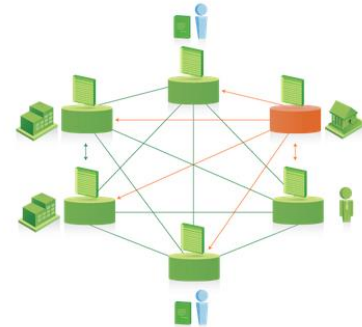
---

# Concepts and technologies: Blockchain

[https://www.ibm.com/blockchain/what\\_is\\_blockchain.html](https://www.ibm.com/blockchain/what_is_blockchain.html)

## Before

- Asset ownership and transfer between businesses is currently inefficient, slow, costly and vulnerable to manipulation.
- Everyone has their own ledger where discrepancies between business parties can increase settlement times.
- A new way is needed for Internet-age market enablement.



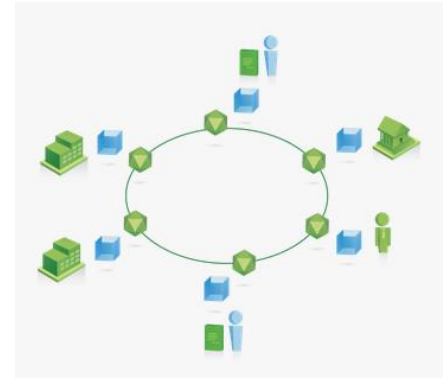


# Concepts and technologies: Blockchain

[https://www.ibm.com/blockchain/what\\_is\\_blockchain.html](https://www.ibm.com/blockchain/what_is_blockchain.html)

## After

- Blockchain technologies can be used to share a ledger across
- the business network.
- The network will be private to the parties concerned, permissioned so only authorized parties are allowed to join
- Secure using cryptographic technology to ensure that participants only see what they are allowed to see.
- The shared ledger will be more robust, since it is replicated and distributed.
- All transactions against the ledger will require consensus across the network, where provenance of information is clear and transparent.
- Transactions will be immutable (unchangeable) and final.



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# Concepts and technologies: Shared ledger

[https://www.ibm.com/blockchain/what\\_is\\_blockchain.html](https://www.ibm.com/blockchain/what_is_blockchain.html)

## **Shared ledger**

It can act as a source of truth for businesses doing transactions on a blockchain:

- Records all transactions across the business network
- Is shared among participants
- Is replicated so each participant has their own copy
- Is permissioned, so participants see only appropriate transactions

Often, companies have multiple ledgers for multiple business networks in which they participate. It can be used for recording and totaling financial transactions.

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# Concepts and technologies: Smart contracts

[https://www.ibm.com/blockchain/what\\_is\\_blockchain.html](https://www.ibm.com/blockchain/what_is_blockchain.html)

## **Smart contracts**

A smart contract can include a digital asset which is anything that has an owner and can be converted into value. Digital assets can be tangible or intangible. A smart contract can also include a digital representation of a set of business rules:

- Is embedded in the blockchain
- Is executed in a transaction
- Is verifiable, signed, and encoded in a programming language
- For example, it defines conditions under which corporate bond transfer occurs

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# Concepts and technologies: Consensus

[https://www.ibm.com/blockchain/what\\_is\\_blockchain.html](https://www.ibm.com/blockchain/what_is_blockchain.html)

## Consensus

Entries in the ledger are synchronized to all ledgers in the network. Consensus ensures that these shared ledgers are exact copies, and lowers the risk of fraudulent transactions since tampering would have to occur across many places at the exact same time.

- All parties agree to the transaction and validate it via the peer network.
- Rules can also be established to validate transactions.
- This trusted and trustless participation makes commitment possible at a low cost.

IBM Blockchain uses a “pluggable” consensus system to meet the needs of different industry segments.

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# Concepts and technologies: Privacy and Confidentiality

[https://www.ibm.com/blockchain/what\\_is\\_blockchain.html](https://www.ibm.com/blockchain/what_is_blockchain.html)

## **Privacy and confidentiality**

- Ability to protect records with a personal digital signature —
  - the blockchain generates a private and public key to seal that record.
- It is encrypted, hashed, and sent to the network of validating nodes
- Unique IDs for customer, invoice and reference numbers
- Although the ledger is shared, sometimes participants require:
  - Private transactions
- Identities that cannot be linked to specific transactions
- Transactions need to be authenticated, and cryptography is central to these processes.

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## Concepts and technologies: Chaincode

<https://github.com/IBM-Blockchain/learn-chaincode>

- Chaincode is Go (GoLang) or Java code that enables users to interact with a blockchain network.
- Whenever you 'invoke' a transaction on the network, you are calling a function in chaincode that reads and writes values to the ledger.

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# Chaincode Hello World

<https://github.com/ALT-F1/chaincode-helloworld/blob/master/helloworld.go>

```
/*
The MIT License (MIT)
*/

....
// HelloWorld example simple Chaincode implementation
type HelloWorld struct {
}

// Init is called during Deploy transaction after the container has been
func (t *HelloWorld) Init(stub *shim.ChaincodeStub, function string, args []string) ([]byte, error) {
    ....
}
// Invoke is called for every Invoke transactions. The chaincode may change its state variables
func (t *HelloWorld) Invoke(stub *shim.ChaincodeStub, function string, args []string) ([]byte, error) {
    fmt.Printf("HelloWorld in Invoke with function %s!\n", function)
    if function != "invoke" {
        return nil, errors.New("Invalid invoke function name. Expecting \"invoke\"")
    }
    .....}
}
```

---

# Chaincode Hello World

<https://github.com/ALT-F1/chaincode-helloworld/blob/master/helloworld.go>

```
// Query is called for Query transactions. The chaincode may only read
// (but not modify) its state variables and return the result
func (t *HelloWorld) Query(stub *shim.ChaincodeStub, function string, args []string) ([]byte, error) {
    myLogger.Debug("HelloWorld Query is called!\n")
    if function != "query" {
        return nil, errors.New("Invalid query function name. Expecting \"query\"")
    }
    .....
}

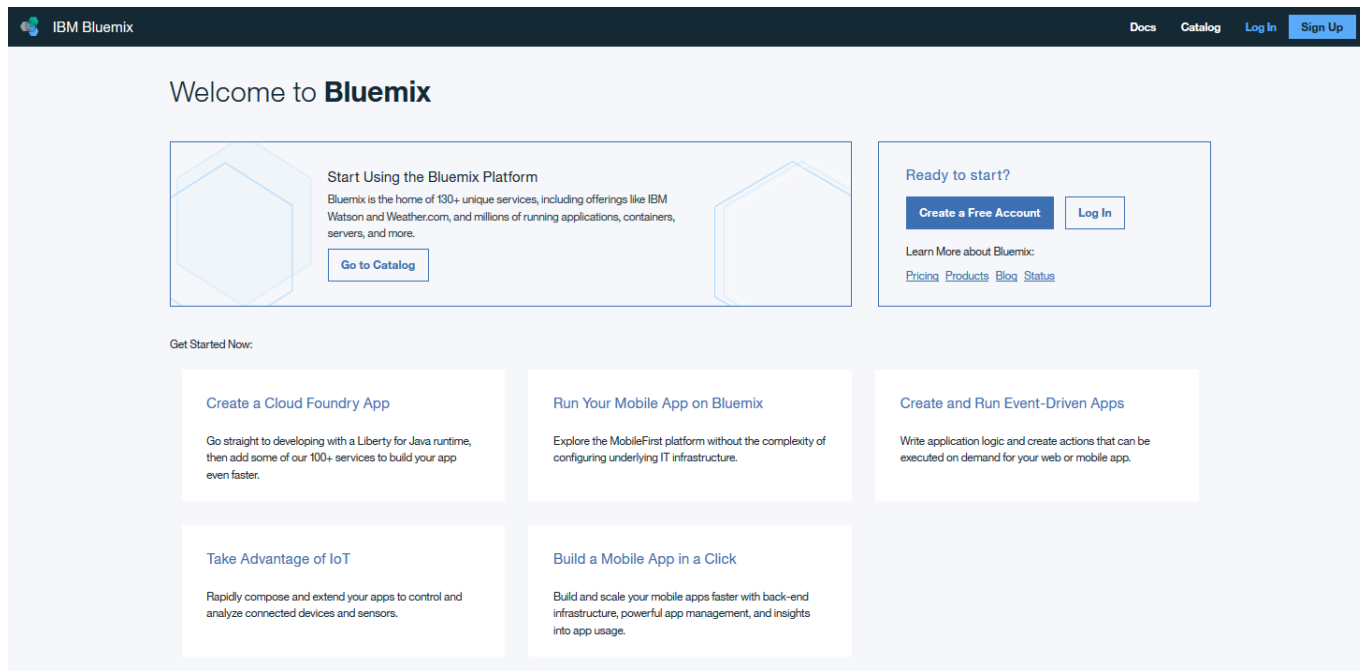
func main() {
    myLogger.Debug("HelloWorld Main\n")
    err := shim.Start(new(HelloWorld))
    if err != nil {
        fmt.Printf("Error starting HelloWorld chaincode: %s\n", err)
    }
}
```



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## **Section 4: Hands-on Blockchain on Bluemix**

# Sign up or log into bluemix.net and go to the Bluemix catalog




The screenshot shows the IBM Bluemix homepage. At the top is a dark navigation bar with the IBM Bluemix logo on the left and links for Docs, Catalog, Log In, and a highlighted Sign Up button on the right. The main content area has a light blue background. It starts with a 'Welcome to Bluemix' heading. Below this are two primary action boxes. The left box, titled 'Start Using the Bluemix Platform', describes the range of services available and includes a 'Go to Catalog' button. The right box, titled 'Ready to start?', features 'Create a Free Account' and 'Log In' buttons, along with links to learn more about Bluemix. Below these is a 'Get Started Now:' section with six cards arranged in a 2x3 grid. Each card provides a specific starting point for users, such as creating a Cloud Foundry app, running mobile apps, or building IoT solutions.

IBM Bluemix

Docs Catalog Log In **Sign Up**

## Welcome to **Bluemix**



**Start Using the Bluemix Platform**

Bluemix is the home of 130+ unique services, including offerings like IBM Watson and Weather.com, and millions of running applications, containers, servers, and more.

[Go to Catalog](#)

**Ready to start?**

[Create a Free Account](#) [Log In](#)

Learn More about Bluemix:

[Pricing](#) [Products](#) [Blog](#) [Status](#)

Get Started Now:

**Create a Cloud Foundry App**

Go straight to developing with a Liberty for Java runtime, then add some of our 100+ services to build your app even faster.

**Run Your Mobile App on Bluemix**

Explore the MobileFirst platform without the complexity of configuring underlying IT infrastructure.

**Create and Run Event-Driven Apps**

Write application logic and create actions that can be executed on demand for your web or mobile app.



**Take Advantage of IoT**

Rapidly compose and extend your apps to control and analyze connected devices and sensors.

**Build a Mobile App in a Click**

Build and scale your mobile apps faster with back-end infrastructure, powerful app management, and insights into app usage.

# Blockchain in the Bluemix Catalog

 IBM Bluemix Catalog

259

Catalog

Support

Account

All Categories (1) >

Infrastructure

Compute

Storage

Network

Security

Apps


Boilerplates


Cloud Foundry Runtimes

Containers

OpenWhisk

Mobile

 Blockchain


Filter 

Showing 1 result for "Blockchain" in 1 category

Services

Application Services

Deliver new web and mobile apps.



**Blockchain**

Utilize IBM's Blockchain Technology within

IBM

# Blockchain in the Bluemix Catalog

IBM Bluemix Catalog

255

Catalog

Support

Account

Security business networks which features a 4 node network running on dedicated infrastructure.

IBM

Connect to:

Leave unbound

[View Docs](#)

AUTHOR IBM

PUBLISHED 10/21/2016

TYPE Service



LOCATION US South

and more time focusing on writing your applications.

- **Create confidential digital assets**  
Create digital transactions in your test applications that are processed quickly and securely over your permissioned network.
- **Work with chaincode**  
Smart contracts, written in chaincode, contain embedded business logic that allows you to define assets and write transaction instructions.

## Images

Click an image to enlarge and view screen captures, slides, or videos. Screen caps show the user interface for the service after it has been provisioned.



## Pricing Plans

Monthly prices shown are for country or region: [United States](#)

PLAN	FEATURES	PRICING
✓ Starter Developer plan (beta)	<ul style="list-style-type: none"><li>• 4 peers and a Cert Authority</li><li>• Deploy and test chaincode</li><li>• Dashboard with logs, controls, and APIs</li><li>• Sample apps with source code</li></ul>	Free

Need Help?  
[Contact Bluemix Sales](#)

Estimate Monthly Cost  
[Cost Calculator](#)

Create

# Blockchain in the Bluemix Catalog

[https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain\\_overview.html](https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain_overview.html)

## IBM Blockchain

Documentation

### About blockchain

*Last updated: 23 September 2016 | [Edit In GitHub](#)*

#### What is blockchain?

Blockchain is a technology for a new generation of transactional applications that establishes trust, accountability and transparency, while streamlining business processes. The blockchain network was first introduced by bitcoin, but its practical uses extend far beyond cryptocurrency exchanges. With blockchain, IBM is reimagining the most fundamental business exchanges, and opening the door to a new world of digital interactions.

Blockchain is projected to vastly reduce the cost and complexity of cross-enterprise business processes. Its distributed ledger makes it easier to create cost-efficient business networks, where virtually anything of value can be tracked and traded, without a centralized point of control.

Blockchain is already showing great promise across a broad range of business applications. As just one example, blockchain networks allow securities trades to be settled in minutes, rather than days. Blockchain is also helping companies streamline the flow of goods and payments, and enabling manufacturers to reduce product recalls by openly sharing production logs with OEMs and regulators.

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Getting started

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What you need to know

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› [About blockchain](#)

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› Network plans

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› HFC SDK for Node.js

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› Testing blockchain networks

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› Dashboard monitor

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› **Samples and tutorials**

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Getting support

# Blockchain in the Bluemix Catalog – sample apps the tutorials

[https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain\\_tutorials.html](https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain_tutorials.html)

## Sample apps and tutorials

*Last updated: 5 October 2016 | [Edit In GitHub](#)*

The following samples demonstrate how applications and chaincode function in an IBM Blockchain network. To learn more about the Hyperledger Fabric v0.5 code, which underpins your blockchain network, visit the [Fabric Docs](#) section of the Linux Foundation's Hyperledger Project.

To experience chaincode applications in action, you can immediately deploy the Marbles, Commercial Paper or Car Lease demo below (click a Deploy to Bluemix button). Or continue reading to explore the Hello Chaincode tutorial.

-  **Marbles**
-  **Commercial Paper**
-  **Car Lease**

## Using the Hello Chaincode tutorial

This tutorial guides you through using basic building blocks to code an elementary chaincode application. You will incrementally build a working chaincode that creates generic assets for exchanging on a network. Then you will interact with your chaincode through the network API. After completing this tutorial, you will be able to answer the following questions:

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Getting started

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What you need to know

---

› About blockchain

---

› Network plans

---

› HFC SDK for Node.js

---

› Testing blockchain network

---

› Dashboard monitor

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▼ [Samples and tutorials](#)

Using the chaincode tutorial

Requirements for demos

Using Marbles demo

Using Commercial Paper demo

Using Car Lease demo

Non-deterministic chaincode

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Getting support

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# Lab 1 Marbles, deploy to Bluemix

[https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain\\_tutorials.html](https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain_tutorials.html)

View your app

## Sample apps and tutorials

*Last updated: 5 October 2016 | [Edit In GitHub](#)*


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-  **Marbles**
-  **Commercial Paper**
-  **Car Lease**

Deploy this application to Bluemix

Deploying this app will create a private DevOps Services project for you. [Learn more.](#)

**MARBLES**  
GIT URL: <https://github.com/ibm-blockchain/marbles.git>  
GIT BRANCH: master

APP NAME  
marbles-lennartf-1321

REGION	ORGANIZATION	SPACE
IBM Bluemix US S...	all@us.ibm.com	dev

**DEPLOY**

📢 New! The toolchains beta feature is now available. [Deploy this example using toolchains!](#)


[https://github.com/IBM-Blockchain/marbles/blob/master/tutorial\\_part1.md](https://github.com/IBM-Blockchain/marbles/blob/master/tutorial_part1.md)

# Lab 1 Marbles – create marbles

[https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain\\_tutorials.html](https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain_tutorials.html)

Deploy this application to Bluemix


Deploying this app will create a private DevOps Services project for you. [Learn more](#)



**MARBLES**

GIT URL: <https://github.com/ibm-blockchain-marbles.git>  
GIT BRANCH: master

- ✓ Created project successfully
- ✓ Cloned repository successfully
- ✓ Configured pipeline successfully
- ✓ Deployed to Bluemix successfully

 Now! The [toolchains](#) beta feature is now available. [Deploy this example using toolchains!](#)

**Success!**

You've added an instance of this app to your organization in Bluemix.

[VIEW YOUR APP](#) [EDIT CODE](#)

MARBLES P1


[HOME](#) [CREATE](#)

# Marbles

TIME: 10/27/2016 08:20PM UTC

[Bob's](#) [Leroy's](#)

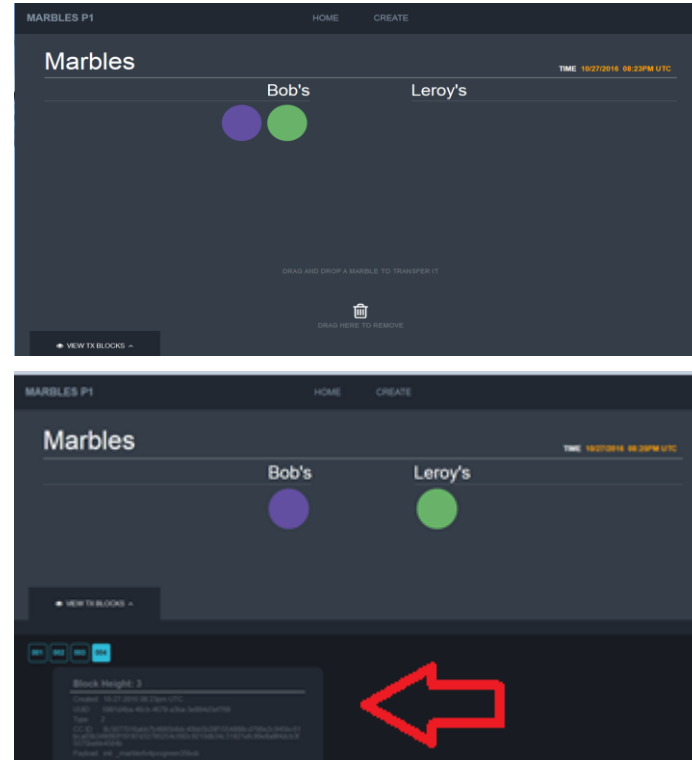
DRAG AND DROP A MARBLE TO TRANSFER IT

  
DRAG HERE TO REMOVE



# Lab 1 Marbles – create marbles and look at the Blockchain blocks

[https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain\\_tutorials.html](https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain_tutorials.html)



# Lab 1 Marbles – Edit Code

[https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain\\_tutorials.html](https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain_tutorials.html)

The screenshot shows the IBM Bluemix DevOps Services interface. The top navigation bar includes 'DASHBOARD', 'MY PROJECTS', 'EXPLORE', 'HELP', 'BLOG', and 'COMMUNITY'. Below this is a toolbar with 'File', 'Edit', 'View', 'Tools', and a status bar indicating 'marbles-lennartf-1353 (running: normal)'. The main editor area is titled 'lennartf | marbles-lennartf-1353' and displays the 'README.md' file. The left sidebar shows a file tree with various project files and folders, including 'bluemix', 'git', 'doc\_images', 'launchConfigurations', 'public', 'routes', 'scss', 'utils', 'views', '.cfignore', '.gitignore', '.jshintignore', '.jshintrc', 'app.js', 'busters\_css.json', 'busters\_js.json', 'gulpfile.js', 'i\_lost\_my\_marbles.md', 'LICENSE', 'manifest.yml', 'marbles\_demo\_notes.md', 'mycreds.json', 'package.json', 'README.md', 'setup.js', 'tutorial\_part1.md', and 'tutorial\_part2.md'. The main content area of the README.md file includes a 'Deploy to Bluemix' button, a section titled 'Application Background' with a paragraph about the application's purpose and a list of marble attributes, and a 'Tutorial / Documentation' section with links to chaincode documentation and Marbles tutorials. At the bottom, there is a 'Privacy Notice' section.

IBM Bluemix DevOps Services

DASHBOARD MY PROJECTS EXPLORE HELP BLOG COMMUNITY

File Edit View Tools marbles-lennartf-1353 (running: normal) Live Edit EDIT CODE TRACK & PLAN BUILD & DEPLOY

lennartf | marbles-lennartf-1353

▼ README.md

## Marbles Demo

Deploy to Bluemix

## Application Background

Hold on to your hats everyone, this application is going to demonstrate transferring marbles between two users leveraging IBM Blockchain. We are going to do this in Node.js and a bit of GoLang. The backend of this application will be the GoLang code running in our blockchain network. The chaincode itself will create a marble by storing it to the chaincode state. The chaincode itself is able to store data as a string in a key/value pair setup. Thus we will stringify JSON objects to store more complex structures.

Attributes of a marble:

```
1. name (unique string, will be used as key)
1. color (string, css color names)
1. size (int, size in mm)
1. user (string)
```

We are going to create a Web UI that can set these values and pass them to the chaincode. Interacting with the chaincode is done with a HTTP REST call to a peer on the network. The ibc-js SDK will abstract the details of the REST calls away. This allow us to use dot notation to call our GoLang functions (such as `chaincode.init_marble(args)`).

Start the tutorials below to have your own marbles blockchain demo!

### Tutorial / Documentation

- Looking for chaincode documentation? Check out the [learn chaincode](#) repo - start here!
- Tutorial for Marbles [Part 1](#)
- Tutorial for Marbles [Part 2](#)
- Documentation for IBM Blockchain [IBC-JS SDK](#) (our REST based SDK)

### Projects Contents

If you run marbles on local host you will have these two urls:

- Marbles Part 1 - <http://localhost:3000/p1>
- Marbles Part 2 - <http://localhost:3000/p2>

### Privacy Notice

# Lab 1 Marbles – navigate to the Bluemix Dashboard

The screenshot displays the IBM Bluemix Dashboard. On the left, a dark sidebar contains a navigation menu with icons and labels for 'Apps', 'Services', 'Infrastructure', 'Dashboard' (highlighted with a red box), 'Cloud', 'Containers', 'Virtual Servers', and 'Mobile'. The main content area has a dark header with the user's name 'Lennart Frantzell's Account', location 'United Kingdom', email 'all@us.ibm.com', and a profile icon. Below the header, a search bar and a 'Filter' button are visible. The dashboard is organized into sections: 'Infrastructure' (with a sub-section 'Compute' titled 'Build your virtual environments'), 'Storage' (titled 'Order storage.'), and 'Network'. Each section contains several service cards with icons, titles, descriptions, and an 'IBM' logo. The 'Compute' section includes 'Bare Metal Server (Hourly)', 'Bare Metal Server (Monthly)', 'Virtual Server (Hourly)', and 'Virtual Server (Monthly)'. The 'Storage' section includes 'Block Storage - Endurance (0.25 IOPS/GB)', 'Block Storage - Endurance (2 IOPS/GB)', 'Block Storage - Endurance (4 IOPS/GB)', 'Block Storage - Performance', 'Content Delivery Network', and 'File Storage - Endurance (0.25 IOPS/GB)'.

Docs

Lennart Frantzell's Account | United Kingdom : all@us.ibm.com : Lennart

255 Catalog Support Account

Apps

Services

Infrastructure

Dashboard

Cloud

Containers

Virtual Servers

Mobile

Search

Filter

Infrastructure

Compute

Build your virtual environments.

**Bare Metal Server (Hourly)**  
Bare metal servers provide the raw horsepower you demand for your processor-intensive and disk.  
IBM

**Bare Metal Server (Monthly)**  
Bare metal servers provide the raw horsepower you demand for your processor-intensive and disk.  
IBM

**Virtual Server (Hourly)**  
Our virtual servers deliver a higher degree of customization, transparency, predictability, and  
IBM

**Virtual Server (Monthly)**  
Our virtual servers deliver a higher degree of customization, transparency, predictability, and  
IBM

**VMware Solutions**  
Order VMware Cloud Foundation or VMware vCenter Server instances.  
IBM

Storage

Order storage.

**Block Storage - Endurance (0.25 IOPS/GB)**  
Persistent iSCSI based storage with high-powered performance and capacity up to 12TB.  
IBM

**Block Storage - Endurance (2 IOPS/GB)**  
Persistent iSCSI based storage with high-powered performance and capacity up to 12TB.  
IBM

**Block Storage - Endurance (4 IOPS/GB)**  
Persistent iSCSI based storage with high-powered performance and capacity up to 12TB.  
IBM

**Block Storage - Performance**  
Persistent iSCSI based storage with high-powered performance and capacity up to 12TB.  
IBM

**Content Delivery Network**  
The Content Delivery Network service distributes content where it is needed. The first time content is requested  
IBM

**File Storage - Endurance (0.25 IOPS/GB)**  
Fast and flexible NFS-based file storage with capacity options from 20GB to 12TB.  
IBM

# Lab 1 Marbles, see your Marbles app in the Bluemix Dashboard

Docs

×

Apps

Services

Infrastructure

Dashboard

Cloud Foundry Apps

Containers

Virtual Servers

Mobile

Lennart Frantzell's Accou... | United Kingdom | alf@us.ibm.com | Lennart

255

Catalog

Support

Account

(5)

Create Application

Applications 2,750 GB/8 GB Used

ROUTE	MEMORY (MB)	INSTANCES	RUNNING	STATE	ACTIONS
<a href="#">Bob-and-Leroy-car-lease-demo-1516.eu-gb.mybluemix.net</a>	512	1	1	Running	
<a href="#">car-lease-demo-lennartf-1234.eu-gb.mybluemix.net</a>	512	1	1	Running	
<a href="#">cp-web-lennartf-1129.eu-gb.mybluemix.net</a>	512	1	1	Running	
<a href="#">marbles-bob-and-leroy-151.eu-gb.mybluemix.net</a>	512	1	1	Running	
<a href="#">marbles-lennartf-432.eu-gb.mybluemix.net</a>	512	1	1	Running	

Create Service

SERVICE OFFERING	PLAN	ACTIONS
------------------	------	---------

# Lab 1 Marbles – The underlying architecture

Cloud Foundry Applications 768 MB/8 GB Used

NAME	ROUTE	MEMORY ...	INSTANCES	RUNNING	STATE	ACTIONS
marbles-lennartf...	<a href="#">marbles-lennartf-432.eu-gb.mybl...</a>	512	1	1	<span style="color: green;">●</span> Running	<a href="#">↺</a> <a href="#">↻</a> <a href="#">⋮</a>

All Services (1)

Create Service +

Services 1/40 Used

NAME	SERVICE OFFERING	PLAN	ACTIONS
myblockchain	Blockchain	ibm-blockchain-plan-5-prod	<a href="#">⋮</a>

<https://github.com/ibm-blockchain/marbles-chaincode>

Hyperledger Framework

<https://github.com/hyperledger/fabric/tree/master/docs>

# Lab 1 Marbles – the Bluemix dashboard, navigate to the console

manifesttest.yml		128	1	1	Running		
marbles-lennartf-1317	<a href="https://marbles-lennartf-1317.mybluemix.net">marbles-lennartf-1317.mybluemix.net</a>	512	1	1	Running		
MobileFoundation-r...	<a href="#">mobilefoundation-rk-fe-server.myblu...</a>	1024	1	1	Running		
NodeRedNI	<a href="https://NodeRedNI.mybluemix.net">NodeRedNI.mybluemix.net</a>	512	1	1	Running		
outthink	<a href="https://outthink.mybluemix.net">outthink.mybluemix.net</a>	128	1	1	Running		

# Lab 1 Marbles – The Bluemix console, navigate to DevOps services (Edit Code)

[https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain\\_tutorials.html](https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain_tutorials.html)

The screenshot shows the Bluemix console interface for an application named 'marbles-lennartf-1317'. The status is 'your app is running'. The main dashboard includes four metrics: Buildpack (SDK for Node.js™), Instances (1, All instances are running, Health is 100%), MBs per instance (512), and Total MB Allocation (640 MBs still available). Below these are sections for Connections, Runtime Cost (\$0.49), Activity Log, and Continuous Delivery. The Continuous Delivery section shows a GIT URL and two buttons: 'Configure' and 'Edit Code', both of which are circled in red in the original image.

**marbles-lennartf-1317** Status: ● your app is running View App

**Runtime**

- BUILDPACK**  
SDK for Node.js™
- INSTANCES**  
1  
All instances are running  
Health is 100%
- MBs PER INSTANCE**  
512
- TOTAL MB ALLOCATION**  
640 MBs still available

**Connections**

No services are connected to this app  
You can create or bind a service.

[Connect New](#) [Connect Existing](#)

**Runtime Cost**

**\$0.49**  
Current Charges for Billing Period

**\$0.49**  
Estimated Total for Billing Period  
(10/01-10/31)

Current and estimated cost excludes [connected services](#).

[View Full Usage Details](#)

**Activity Log**

- an instance of the app crashed: out of memory  
exit status: 255, CRASHED  
10/28/2016 2:24 AM | marbles-lennartf-1317
- started marbles-lennartf-1317 app  
10/27/2016 1:19 PM | al@us.ibm.com
- updated module: lennartf-1317

**Continuous Delivery**

**GIT URL**  
<https://hub.jazz.net/git/lennartf/marbles-lennartf-1317>

[Configure](#) [Edit Code](#)

# Lab 1 Marbles – DevOps Services Build and Deploy

The screenshot displays the IBM Bluemix DevOps Services interface for a pipeline named "marbles-lennartf-1317". The top navigation bar includes links for DASHBOARD, MY PROJECTS, EXPLORE, HELP, BLOG, and COMMUNITY. The main header shows the pipeline name and buttons for EDIT CODE, TRACK & PLAN, and BUILD & DEPLOY. A video player on the left shows a "Build & Deploy Pipeline Core Concepts" video. The main content area welcomes the user to the "Build & Deploy Pipeline" and explains the workflow: pushing changes to the repository triggers a new build and then a deployment. It also provides links to "Build & Deploy Docs". Below this, the "Pipeline: All Stages" section shows two stages: "Empty Build Stage" and "Deploy to Bluemix". The "Empty Build Stage" shows a "STAGE PASSED" status, with a "LAST INPUT" of a Git commit and a "LAST EXECUTION RESULT" of "Empty Build Job 1". The "Deploy to Bluemix" stage also shows a "STAGE PASSED" status, with a "LAST INPUT" of "Stage: Empty Build Stage" and a "LAST EXECUTION RESULT" of a deployment to "marbles-lennartf-1317.mybluemix.net". A "+ ADD STAGE" button is visible on the right.

IBM Bluemix DevOps Services

DASHBOARD MY PROJECTS EXPLORE HELP BLOG COMMUNITY

lennartf | marbles-lennartf-1317

EDIT CODE TRACK & PLAN BUILD & DEPLOY

### Welcome to the Build & Deploy Pipeline

If you want to automate your continuous deployments, set up stages to retrieve input and run jobs, such as builds, tests, and deployments.

We've configured the first two stages and have deployed your sample app for you. Pushing changes to the repository automatically trigger a new build and then a deployment. To learn more about using [IBM Bluemix](#) with IBM Bluemix DevOps Services together for development and continuous integration, check out the [Build & Deploy Docs](#)

Pipeline: All Stages

#### Empty Build Stage

STAGE PASSED

LAST INPUT [Git URL](#)

Last commit by Lennart Fran... 14 hr ago  
[Imported from https://github.com/ibm-b...](#)

JOBS [View logs and history](#)

Empty Build... Succeeded 14 hr ago

LAST EXECUTION RESULT

Empty Build Job 1

#### Deploy to Bluemix

STAGE PASSED

LAST INPUT Stage: Empty Build Stage /...

Empty Build Job 1

JOBS [View logs and history](#)

Push to Clo... Succeeded 14 hr ago

LAST EXECUTION RESULT




marbles-lennartf-1317  
[marbles-lennartf-1317.mybluemix.net](#)  
[View runtime log](#)

+ ADD STAGE



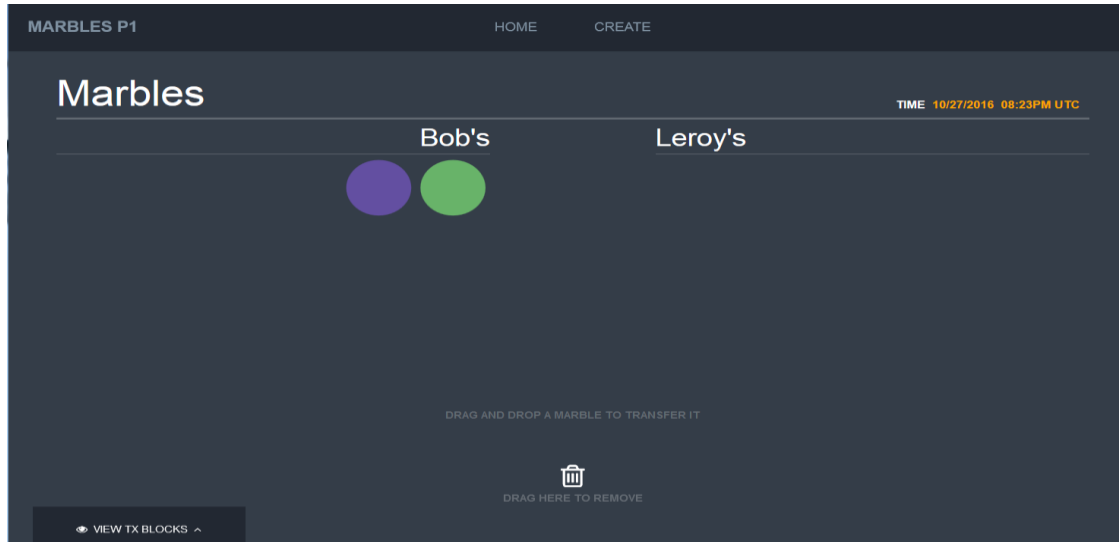
# Lab 1 Marbles – Console, navigate to your app

[https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain\\_tutorials.html](https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain_tutorials.html)

manifesttest.yml		128	1	1	 Running		
marbles-lennartf...	<a href="https://marbles-lennartf-1317.mybluemix.net">marbles-lennartf-1317.mybluemix..</a>	512	1	1	 Running	 	
MobileFoundatio...	<a href="https://mobilefoundation-rk-fe-server.m...">mobilefoundation-rk-fe-server.m...</a>	1024	1	1	 Running	 	
NodeRedNI	<a href="https://NodeRedNI.mybluemix.net">NodeRedNI.mybluemix.net</a>	512	1	1	 Running	 	

# Lab 1 Marbles – View Your App

[https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain\\_tutorials.html](https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain_tutorials.html)




# Lab 2 Commercial Paper, deploy and view your app

[https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain\\_tutorials.html](https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain_tutorials.html)

View your app

### Deploy this application to Bluemix

Deploying this app will create a private DevOps Services project for you. [Learn more.](#)



**CP-WEB**  
GIT URL: <https://github.com/IBM-Blockchain/cp-web.git>  
GIT BRANCH: master

APP NAME

REGION

ORGANIZATION


SPACE

**i** New! The **toolchains** beta feature is now available. [Deploy this example using toolchains!](#)

You are logged in as [alf@us.ibm.com](#). [Log out.](#)  
[Terms of Use](#)

### Deploy this application to Bluemix

Deploying this app will create a private DevOps Services project for you. [Learn more.](#)



**CP-WEB**  
GIT URL: <https://github.com/IBM-Blockchain/cp-web.git>  
GIT BRANCH: master

✓ Created project successfully

✓ Cloned repository successfully

✓ Configured pipeline successfully

✓ Deployed to Bluemix successfully

**i** New! The **toolchains** beta feature is now available. [Deploy this example using toolchains!](#)

### Success!


You've added an instance of this app to your organization in Bluemix.

You are logged in as [alf@us.ibm.com](#). [Log out.](#)  
[Terms of Use](#)

# Lab 2 Commercial Paper – View Your App

Begin by registering three users, including one named auditor, save passwords

COMMERCIAL PAPER

 LOGIN ▾

## Login

---

Username

username

Password

Login

## Register

---

Username


username

Register

User roles are assigned through tags in the user name. Include the string 'auditor' in your user name to register as that user type. Everyone else is will be considered a regular user. Updates to the chaincode will remove this limitation in the future.

# Lab 2 Commercial Paper – Login and create commercial paper

COMMERCIAL PAPER

 LOGIN ▾

## Login

---

Username

username

Password

Login

## Register

---

Username

username


Register

User roles are assigned through tags in the user name. Include the string 'auditor' in your user name to register as that user type. Everyone else is will be considered a regular user. Updates to the chaincode will remove this limitation in the future.

# Lab 2 Commercial Paper – Login and create commercial paper


COMMERCIAL PAPER

CREATETRADE

STEPHEN ▾

Create Paper

TIME 10/31/2016 09:40PM UTC



IBM

\$100,000 ▾PAR

1 ▾QTY

3.25% ▾DISCOUNT


15 days ▾MATURITY

✓ CREATE

# Lab 2 Commercial Paper – View Your App – Trade Center

COMMERCIAL PAPER

CREATETRADE


STEPHEN ▾

## Trade Center

TIME 10/31/2016 09:38PM UTC

Account Balance:\$9,025,000.00

Filter Trades

DATE↑	CUSIP	TICKER	PAR	QTY	DISCOUNT	MATURITY	ISSUER	OWNER	ACTION
10/31 09:40PM	Stephen000ALF	TORONTO	\$100,000.00	11	10	15	Stephen	Stephen	⇌ BUY 1
10/31 06:49PM	Lennart000AAV	BLUEMIX	\$1,000,000.00	1	10	90	Lennart	Stephen	⇌ BUY 1
10/31 06:49PM	Lennart000AAV	BLUEMIX	\$1,000,000.00	1	10	90	Lennart	Syed	⇌ BUY 1
10/31 06:49PM	Lennart000AAV	BLUEMIX	\$1,000,000.00	9	10	90	Lennart	Lennart	⇌ BUY 1
10/31 06:42PM	Lennart000ALF	IBM	\$100,000.00	2	3.25	15	Lennart	Syed	⇌ BUY 1
 VIEW TX BLOCKS ^	rt000ALF	IBM	\$100,000.00	42	3.25	15	Lennart	Lennart	⇌ BUY 1

## Lab 2 Commercial Paper in Bluemix Dashboard

bluemixintro1	<a href="http://bluemixintro1.mybluemix.net">bluemixintro1.mybluemix.net</a>	128	1	1	 Running	  
bluemixintroiot	<a href="http://bluemixintroiot.mybluemix.net">bluemixintroiot.mybluemix.net</a>	512	1	1	 Running	  
cp-web-lennartf...	<a href="http://cp-web-lennartf-1415.mybluemix.net">cp-web-lennartf-1415.mybluemix...</a>	512	1	1	 Running	  
falkenberg	<a href="http://falkenberg.mybluemix.net">falkenberg.mybluemix.net</a>	128	1	0	 Stopped	 
IndiaHackathon...	<a href="http://IndiaHackathonMFSS.mybluemix.net">IndiaHackathonMFSS.mybluemix...</a>	512	1	1	 Running	  
manifesttest.yml		128	1	1	 Running	 



# Lab 2 Commercial Paper in Bluemix Dashboard

The screenshot shows the IBM Bluemix Cloud Foundry Applications dashboard for the application **cp-web-lennartf-1415**. The status is "Your app is running".

**Runtime Metrics:**

- BUILDPACK:** SDK for Node.js™
- INSTANCES:** 1 (All instances are running, Health is 100%)
- MBs PER INSTANCE:** 512
- TOTAL MB ALLOCATION:** 512 (640 MBs still available)

**Connections (1):** cpblockchain

**Runtime Cost:**

- Current Charges for Billing Period:** \$0.41
- Estimated Total for Billing Period (10/01-10/31):** \$0.41
- Current and estimated cost excludes connected services.
- [View Full Usage Details](#)

**Activity Log:**

- started cp-web-lennartf-1415 app  
10/27/2016 2:25 PM | all@us.ibm.com
- updated cp-web-lennartf-1415 app  
changed routes  
10/27/2016 2:25 PM | all@us.ibm.com

**Continuous Delivery:**

- GIT URL:** <https://github.com/jazz.net/gf/lennartf/cp-web-lennartf-1415>
- [Configure](#) (highlighted with a red circle)
- [Edit Code](#) (highlighted with a red circle)

# Lab 2 Commercial Paper – DevOps Services – Configure - Build and Deploy

IBM Bluemix DevOps Services

DASHBOARD MY PROJECTS EXPLORE HELP ▾ BLOG COMMUNITY

lennartf | cp-web-lennartf-1415

EDIT CODE TRACK & PLAN BUILD & DEPLOY

Pipeline: All Stages

### Empty Build Stage

STAGE PASSED

LAST INPUT [Git URL](#)

Last commit by Lennart Fran... 12 hr ago  
[Imported from https://github.com/IBM-B...](#)

JOBS [View logs and history](#)

✓ Empty Build... Succeeded 12 hr ago

LAST EXECUTION RESULT

Empty Build Job 1

### Deploy to Bluemix

STAGE PASSED

LAST INPUT Stage: Empty Build Stage /...

Empty Build Job 1

JOBS [View logs and history](#)

✓ Push to Clo... Succeeded 12 hr ago

LAST EXECUTION RESULT

Loading...

+ ADD STAGE

# Lab 2 Commercial Paper – Devops Services – Edit Code – Build and Deploy Chaincode file cp\_cc.go

The screenshot shows a code editor interface with a dark theme. On the left, a file explorer shows the project structure for 'lennartf | cp-web-lennartf-1415'. The 'chain\_code' directory is expanded, and 'cp\_cc.go' is selected. The main editor area displays the content of 'cp\_cc.go'.
















File Explorer Structure:

- lennartf | cp-web-lennartf-1415
  - .bluemix
  - .git
  - launchConfigurations
  - public
  - routes
  - src
    - chain\_code
      - vendor
      - certificate.pem
      - cp-cc
      - cp\_cc.go
    - scss
    - utils
    - views
  - .cfignore
  - .gitignore
  - .jshintignore
  - .jshintrc
  - app.js
  - gulpfile.js
  - haproxy.cfg
  - LICENSE
  - manifest.yml
  - mycreds.json
  - package.json
  - README.md
  - setup.js

Code Editor Content (cp\_cc.go):

```
1  /*
2  Copyright 2016 IBM
3
4  Licensed under the Apache License, Version 2.0 (the "License")
5  you may not use this file except in compliance with the License.
6  You may obtain a copy of the License at
7
8      http://www.apache.org/licenses/LICENSE-2.0
9
10 Unless required by applicable law or agreed to in writing, software
11 distributed under the license is distributed on an "AS IS" BASIS,
12 WITHOUT WARRANTIES OR CONDITIONS OF ANY KIND, either express or implied.
13 See the License for the specific language governing permissions and
14 limitations under the License.
15
16 Licensed Materials - Property of IBM
17 © Copyright IBM Corp. 2016
18 */
19 package main
20
21 import (
22     "encoding/json"
23     "errors"
24     "fmt"
25     "strconv"
26     "time"
27     "strings"
28
29     "github.com/hyperledger/fabric/core/chaincode/shim"
30 )
31
32 var cpPrefix = "cp:"
33 var accountPrefix = "acct:"
34 var accountsKey = "accounts"
35
36 var recentLeapYear = 2016
37
38 // SimpleChaincode example simple Chaincode implementation
39 type SimpleChaincode struct {
40     }
```


## Lab 2 Commercial Paper in Bluemix Dashboard – View App

bluemixintro1	<a href="http://bluemixintro1.mybluemix.net">bluemixintro1.mybluemix.net</a>	128	1	1	 Running	  
bluemixintroiot	<a href="http://bluemixintroiot.mybluemix.net">bluemixintroiot.mybluemix.net</a>	512	1	1	 Running	  
cp-web-lennartf...	<a href="http://cp-web-lennartf-1415.mybluemix.net">cp-web-lennartf-1415.mybluemix...</a>	512	1	1	 Running	  
falkenberg	<a href="http://falkenberg.mybluemix.net">falkenberg.mybluemix.net</a>	128	1	0	 Stopped	 
IndiaHackathon...	<a href="http://IndiaHackathonMFSS.mybluemix.net">IndiaHackathonMFSS.mybluemix...</a>	512	1	1	 Running	  
manifesttest.yml		128	1	1	 Running	 

# Lab 2 Commercial Paper – View Your App – Trade Center

COMMERCIAL PAPER

AUDIT

 AUDITOR ▾


# Trade Center

TIME 10/28/2016 09:02AM UTC

Account Balance:Loading from blockchain...

Filter Trades

DATE↑	CUSIP	TICKER	PAR	QTY	DISCOUNT	MATURITY	ISSUER	OWNER	ACTION
-------	-------	--------	-----	-----	----------	----------	--------	-------	--------

 VIEW TX BLOCKS ^

# Lab 3 Car Lease

[https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain\\_tutorials.html](https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain_tutorials.html)

## Deploy this application to Bluemix

Deploying this app will create a private DevOps Services project for you. [Learn more.](#)



### CAR-LEASE-DEMO

GIT URL: <https://github.com/IBM-Blockchain/car-lease-demo.git>  
GIT BRANCH: master

APP NAME

car-lease-demo-lennartf-1339

REGION

IBM Bluemix US S...

ORGANIZATION

alf@us.ibm.com

SPACE

dev

DEPLOY

New! The **toolchains** beta feature is now available. [Deploy this example using toolchains!](#)

You are logged in as [alf@us.ibm.com](#). [Log out](#)  
[Terms of Use](#)



### CAR-LEASE-DEMO

GIT URL: <https://github.com/IBM-Blockchain/car-lease-demo.git>  
GIT BRANCH: master

- Created project successfully
- Cloned repository successfully
- Configured pipeline successfully
- Deployed to Bluemix successfully

New! The **toolchains** beta feature is now available. [Deploy this example using toolchains!](#)

## Success!

You've added an instance of this app to your organization in Bluemix.

[VIEW YOUR APP](#)

[EDIT CODE](#)

# Lab 3 Car Lease - View App



BLOCKCHAIN CAR LEASING DEMO

## Main Menu:

Welcome to the Car Leasing Demo.

To get a scenario set up click on the link to the admin console then use one of the Create Scenario buttons. This will create cars and move them to their locations.

Otherwise you can create your own cars by clicking on Create Asset.

### Regulator

[Live Stats](#)

[Regulator View](#)

[Create Asset](#)

### Transfer Asset

[Regulator → Manufacturer](#)

[Manufacturer → Dealership](#)

[Dealership → Lease Company](#)

[Lease Company → Lessee](#)

[Lessee → Scrap Merchant](#)

### Update Asset

[Manufacturer Update](#)

### Dispose Asset

[Scrap Merchant → Scrap](#)

### Admin

[Admin Console](#)

# Lab 3 Car Lease - View App

## Admin Console

Demo setup:

Create Simple Scenario

Create Full Scenario

### Creating Scenario

*Creating vehicles ✓*

*Transferring vehicles to manufacturers ✓*

*Updating vehicles' details ✓*


*Transferring vehicles to private owners ✓*

*Demo setup ✓*

OK



## Lab 3 Car Lease - View App

	<b>Scenario Creation Complete</b>
Scenario	Scenario creation complete
	

# Lab 3 Car Lease - Edit Code – Build and Deploy

IBM Bluemix DevOps Services

DASHBOARD MY PROJECTS EXPLORE HELP BLOG COMMUNITY

File Edit View Tools car-lease-demo-lenn... (running: normal) Live Edit: EDIT CODE TRACK & PLAN BUILD & DEPLOY

lennartf | car-lease-demo-lennartf-1339

lennartf | car-lease-demo-lennartf-1339

▼ README.md

## Car Lease Demo

### Deploying the demo

To deploy to Bluemix simply use the button below then follow the instructions. This will generate the NodeJS server and the Blockchain service for you.

Deploy to Bluemix

To deploy the demo locally follow the instructions [here](#)

### Application overview

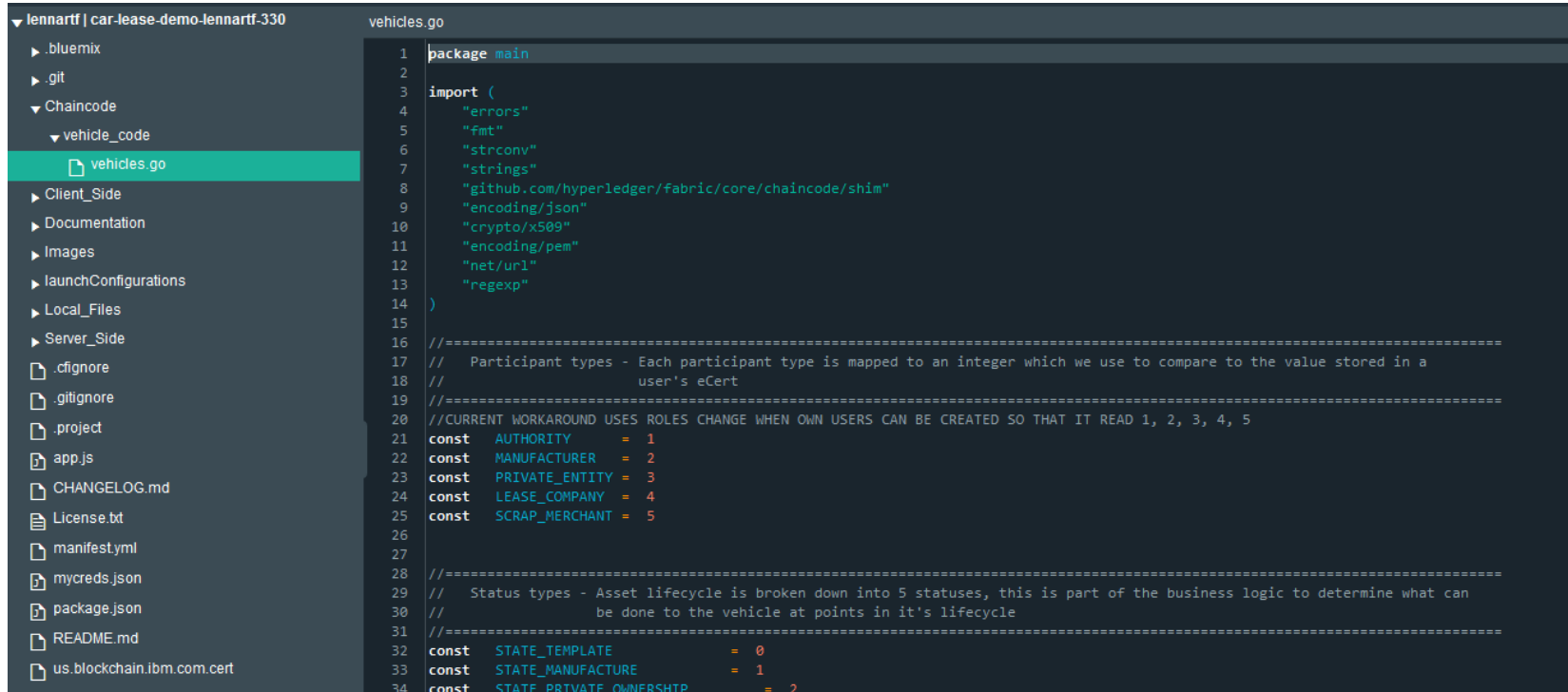
This application is designed to demonstrate how assets can be modeled on the Blockchain using a car leasing scenario. In the scenario vehicles are modeled using Blockchain technology with the following attributes:

Attribute	Type
V5clD	Unique string formed of two chars followed by a 7 digit int, used as the key to identify the vehicle
VIN	15 digit int
Make	String
Model	String
Colour	String
Reg	String
Owner	Identity of participant
Scrapped	Boolean
Status	Int between 0 and 4

LeaseContractID ChaincodeID, currently unused but will store the ID of the lease contract for the vehicle

The application is designed to allow participants to interact with the vehicle assets creating, updating and transferring them as their permissions allow. The participants included in the application are as follows:

# Lab 3 Car Lease - Edit Code – Build and Deploy – Chain Code















The screenshot shows a code editor interface. On the left is a file explorer for a project named 'lennartf | car-lease-demo-lennartf-330'. The 'Chaincode' folder is expanded, showing 'vehicle\_code' and 'vehicles.go' (which is selected). Other files in the explorer include 'Client\_Side', 'Documentation', 'Images', 'launchConfigurations', 'Local\_Files', 'Server\_Side', '.cignore', '.gitignore', '.project', 'app.js', 'CHANGELOG.md', 'License.txt', 'manifest.yml', 'mycreds.json', 'package.json', 'README.md', and 'us.blockchain.ibm.com.cert'.


The main editor area displays the code for 'vehicles.go'. The code is as follows:

```
1 package main
2
3 import (
4     "errors"
5     "fmt"
6     "strconv"
7     "strings"
8     "github.com/hyperledger/fabric/core/chaincode/shim"
9     "encoding/json"
10    "crypto/x509"
11    "encoding/pem"
12    "net/url"
13    "regexp"
14 )
15
16 //=====
17 // Participant types - Each participant type is mapped to an integer which we use to compare to the value stored in a
18 //                      user's eCert
19 //=====
20 //CURRENT WORKAROUND USES ROLES CHANGE WHEN OWN USERS CAN BE CREATED SO THAT IT READ 1, 2, 3, 4, 5
21 const AUTHORITY = 1
22 const MANUFACTURER = 2
23 const PRIVATE_ENTITY = 3
24 const LEASE_COMPANY = 4
25 const SCRAP_MERCHANT = 5
26
27
28 //=====
29 // Status types - Asset lifecycle is broken down into 5 statuses, this is part of the business logic to determine what can
30 //                  be done to the vehicle at points in it's lifecycle
31 //=====
32 const STATE_TEMPLATE = 0
33 const STATE_MANUFACTURE = 1
34 const STATE_PRIVATE_OWNERSHIP = 2
```


# Car Lease in the Bluemix Dashboard

bluemixintroiot	<a href="https://bluemixintroiot.mybluemix.net">bluemixintroiot.mybluemix.net</a>	512	1	1	 Running			
car-lease-demo-	<a href="https://car-lease-demo-lennartf-330.mybluemix.net">car-lease-demo-lennartf-330.mybluemix.net</a>	512	1	1	 Running			
cp-web-lennartf	<a href="https://cp-web-lennartf-1415.mybluemix.net">cp-web-lennartf-1415.mybluemix.net</a>	512	1	1	 Running			

# Car Lease in the Bluemix Console



 car-lease-demo-lennartf-330 Status: ● Your app is running View App

Runtime





BUILDPACK

SDK for Node.js™


 1 

INSTANCES

All instances are running  
Health is 100%

 512 


MBS PER INSTANCE

 512


TOTAL MB ALLOCATION

128 MBs still available ⓘ


Connections (1)

 car\_lease\_blockchain

Activity Log

 started car-lease-demo-lennartf-330 app

10/28/2016 3:32 AM | alf@us.ibm.com

 updated car-lease-demo-lennartf-330 app

changed routes

10/28/2016 3:31 AM | alf@us.ibm.com

Runtime Cost

\$0.00

Current Charges for Billing Period


\$0.00

Estimated Total for Billing Period  
(10/01-10/31)

Current and estimated cost excludes connected services.

View Full Usage Details

Continuous Delivery













 GIT URL

<https://hub.jazz.net/git/lennartf/car-lease-demo-lennartf-330>

Configure

Edit Code

# Car Lease in the Bluemix Dashboard

bluemixintroi	<a href="http://bluemixintroi.mybluemix.net">bluemixintroi.mybluemix.net</a>	512	1	1	 Running			
car-lease-demo-	<a href="http://car-lease-demo-lennartf-330.mybluemix.net">car-lease-demo-lennartf-330.mybluemix.net</a>	512	1	1	 Running			
cp-web-lennartf	<a href="http://cp-web-lennartf-1415.mybluemix.net">cp-web-lennartf-1415.mybluemix.net</a>	512	1	1	 Running			

# Car Lease in the Bluemix Dashboard



BLOCKCHAIN CAR LEASING DEMO

Main Menu:



Just finalizing set up. Please wait...

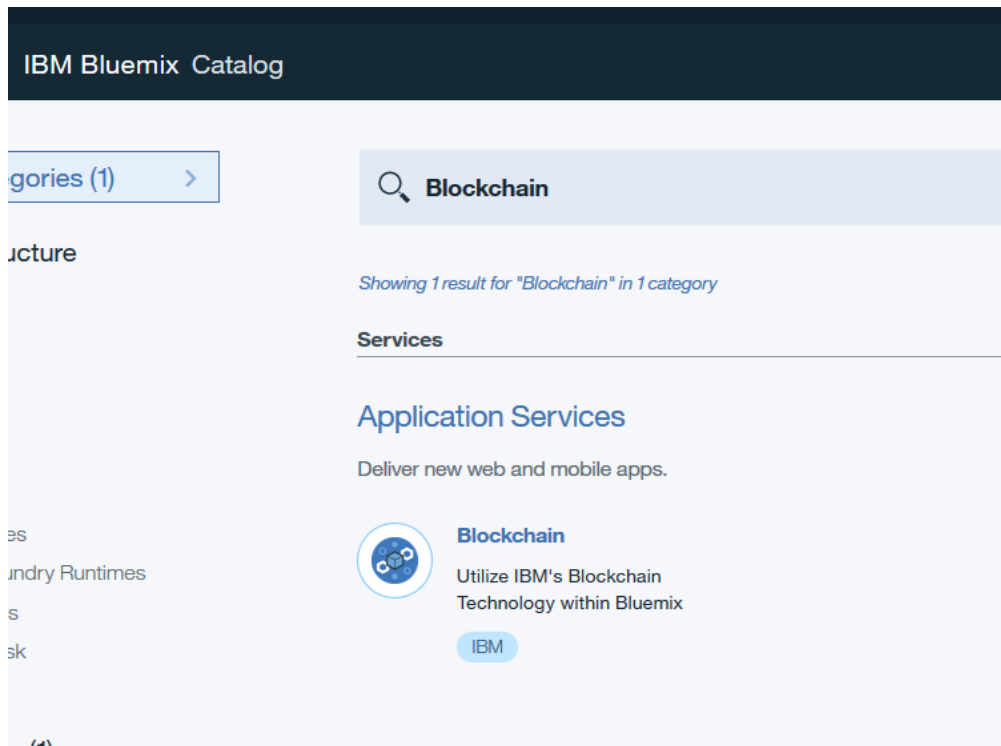
## Regulator

Live Stats  
Regulator View  
Create Asset

## Transfer Asset

Regulator → Manufacturer  
Manufacturer → Dealership  
Dealership → Lease Company  
Lease Company → Leasee  
Leasee → Scrap Merchant

# Bluemix Catalog, locate Blockchain in the catalog





# Bluemix Catalog, create and a Blockchain service

Service name:

Blockchain-kl

Credential name:

Credentials-1

## Features

- **Spin up a test Blockchain Network in one click**

Spend less time creating and managing a blockchain network and more time focusing on writing your applications.

- **Create confidential digital assets**

Create digital transactions in your test applications that are processed quickly and securely over your permissioned network.

- **Membership services**

Take advantage of our first implementation of the membership services module, which encompasses many of the latest advances in cryptography.

- **Work with chaincode**

Smart contracts, written in chaincode, contain embedded business logic that allows you to define assets and write transaction instructions.

ate Monthly Cost

[Calculator](#)

Create

← Application Services

Blockchain-kl

Manage

Service Credentials

Connections


Welcome to the Starter Developer Network  
on IBM Blockchain!

Welcome, alfi@us.ibm.com!

This service is intended for developers who consider themselves early adopters and want to get involved with IBM's approach to business networks that maintain, secure and share a replicated ledger using blockchain technology.

LAUNCH

# Bluemix Catalog, Blockchain service menu, select Demo Chaincode

 IBM Blockchain

Network ID: 3c945fd9b0e645648ef133fd9f8f88d9

NetworkBlockchainDemo ChaincodeAPIsLogsStatusSupport

Peer

Members

Validators

Validators

Validators

Validators

Getting started

Getting Started

Welcome to your blockchain network's console page. From here you can do many things.  
If this is your first time using IBM Blockchain you should deploy some chaincode. Our Demo Chaincode tab can help with that!

Network

Blockchain

Demo Chaincode

APIs

Logs

Deploy your first chaincode!

1) Go to "Demo Chaincode" and select a chaincode template. Then hit deploy.  
2) Click the pre-built query/invoke buttons.  
3) Take the sample to the next level by creating API calls in the "APIs" tab. You can get the chaincode ID from the networks tab.

# Blockchain service, three Applications

Network

Blockchain

Demo Chaincode

APIs

Logs

Status

Support

Not sure how to get started? Pick a demo and deploy its chaincode right from this page!

(Deploying will submit chaincode to your network. You will then be able to interact with the chaincode.)

Application	Description	Links	Interact
<b>Example02</b> 1/5 difficulty	Store two integers named A and B. Subtract from one and add to the other.	<a href="#">Chaincode</a>	<a href="#">Show Actions</a>
<b>Marbles</b> 2/5 difficulty	Create marble assets and trade them with your friend Leroy.	<a href="#">GitHub</a> , <a href="#">Chaincode</a> , <a href="#">Docs</a>	<a href="#">Show Actions</a>
<b>Commercial Paper</b> 3/5 difficulty	Buy and sell business to business monetary loans.	<a href="#">GitHub</a> , <a href="#">Chaincode</a> , <a href="#">Docs</a>	<a href="#">Show Actions</a>

# Blockchain service, Deploy Example02 app

Network

Blockchain

Demo Chaincode

APIs

Logs

Status

Support

Not sure how to get started? Pick a demo and deploy its chaincode right from this page!

(Deploying will submit chaincode to your network. You will then be able to interact with the chaincode.)

Application	Description	Links	Interact
<b>Example02</b> 1/5 difficulty	Store two integers named A and B. Subtract from one and add to the other.	<a href="#">Chaincode</a>	<a href="#">Show Actions</a>
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<b>Commercial Paper</b> 3/5 difficulty	Buy and sell business to business monetary loans.	<a href="#">GitHub</a> , <a href="#">Chaincode</a> , <a href="#">Docs</a>	<a href="#">Show Actions</a>

# Bluemix Example02 sample, look at Chaincode, Transfer and Query

Application	Description	Links	Interact
<b>Example02</b> 1/5 difficulty	Store two integers named A and B. Subtract from one and add to the other.	<a href="#">Chaincode</a>	<a href="#">Show Actions</a> <div>Deploy</div>
Select the correct chaincode		<div>example02: 72c3c395...</div>	<div>Transfer from A to B</div> <div>Transfer from B to A</div> <div>Query A</div> <div>Query B</div>

# Chaincode: Deploy Marbles in the Blockchain Service

## Marbles

2/5 difficulty

Create marble assets and trade them with your friend Leroy.

[GitHub](#), [Chaincode](#), [Docs](#)

[Show Actions](#)

Deploy



## Commercial

## Paper

3/5 difficulty

Buy and sell business to business monetary loans.

[GitHub](#), [Chaincode](#), [Docs](#)

[Show Actions](#)

Deploy



### Demo Chaincode successfully deployed:

Now you can hit an action button below "Actions" to invoke a chaincode function.



Show API details A small square icon with a grid pattern, likely representing an API or data table.

# Blockchain Marbles

## Marbles

2/5 difficulty

Create marble assets and trade them with your friend Leroy.

[GitHub](#), [Chaincode](#), [Docs](#)

[Show Actions](#)

Deploy

Select the correct chaincode

marbles: d827db00...



Create marble

Trade away  
marble

Delete marble

Query marble

# Bluemix Commercial Paper

Commercial  
Paper

3/5 difficulty

Buy and sell business to business  
monetary loans.

[GitHub](#), [Chaincode](#), [Docs](#)

[Show Actions](#)

Deploy



Commercial  
Paper

3/5 difficulty

Buy and sell business to business  
monetary loans.

[GitHub](#), [Chaincode](#), [Docs](#)

[Show Actions](#)

Deploy

Select the correct chaincode

cp: bc25e428...▼

Register Accounts

Seed paper

Buy paper

Query account



# Welcome to the Starter Developer Network on IBM Blockchain!

← Application Services

Blockchain-yk

Manage

Service Credentials

Connections

Welcome to the Starter Developer Network  
on IBM Blockchain!

LAUNCH 

Welcome, alf@us.ibm.com!

This service is intended for developers who consider themselves early adopters and want to get involved with IBM's approach to business networks that maintain, secure and share a replicated ledger using blockchain technology.

# Welcome to your Blockchain Network's console page!

## Getting Started

×

Welcome to your blockchain network's console page. From here you can do many things.

If this is your first time using IBM Blockchain you should [deploy some chaincode](#). Our [Demo Chaincode](#) tab can help with that!

### Network

View the status of your network peers and deployed chain code

### Blockchain

Explore transactions written to the network

### Demo Chaincode

Deploy sample chain code templates in one-click

### APIs

Learn and interact with API docs

### Logs

View peer or membership service logs

### Deploy your first chaincode!

- 1) Go to "Demo Chaincode" and select a chaincode template. Then hit deploy.
- 2) Click the pre-built query/invoke buttons.
- 3) Take the sample to the next level by creating API calls in the "APIs" tab. You can get the chaincode ID from the networks tab.

# Welcome to the IBM Blockchain API

Welcome to our Peer's API Swagger documentation.  
You can use this page to interact with your peers using their REST interface.

`https://7aae381e93524252b7f0cc05a3d9455c-vp1.us.blockchain.ibm.com:444`

(feel free to change the peer url above)

VP0

VP1

VP2

VP3

[+ Network's Enroll IDs](#)

## IBM Blockchain API

Interact with the enterprise blockchain through IBM Blockchain API

### Block

[Show/Hide](#) | [List Operations](#) | [Expand Operations](#)

### Blockchain

[Show/Hide](#) | [List Operations](#) | [Expand Operations](#)

### Chaincode

[Show/Hide](#) | [List Operations](#) | [Expand Operations](#)

### Network

[Show/Hide](#) | [List Operations](#) | [Expand Operations](#)

### Registrar

[Show/Hide](#) | [List Operations](#) | [Expand Operations](#)

### Transactions

[Show/Hide](#) | [List Operations](#) | [Expand Operations](#)

# Welcome to the IBM Blockchain API

## IBM Blockchain API

Interact with the enterprise blockchain through IBM Blockchain API

### Block

Show/Hide | List Operations | Expand Operations

GET

/chain/blocks/{Block}

Individual block information

#### Implementation Notes

The {Block} endpoint returns information about a specific block within the Blockchain. Note that the genesis block is block zero.

#### Response Class (Status 200)

[Model Details](#) | [Model Schema](#)

```
{
  "proposerID": "string",
  "timestamp": {
    "seconds": 0,
    "nanos": 0
  },
  "transactions": [
    {
      "type": "UNDEFINED",
      "chaincodeID": "string",
```

Response Content Type

application/json



---

## **Section 4**

**Where do we go from here**

---

The logo features the text "IBM Bluemix Garage for blockchain" in white, bold, sans-serif font. The background is a dark blue rectangle with a faint, blurred image of a computer screen displaying code.

# IBM Bluemix Garage for blockchain

<https://www.ibm.com/blockchain/garage.html>

---

## Using the Hello Chaincode tutorial

This tutorial guides you through using basic building blocks to code an elementary chaincode application. You will incrementally build a working chaincode that creates generic assets for exchanging on a network.

Then you will interact with your chaincode through the network API.

After completing this tutorial, you will be able to answer the following questions:

- What is chaincode?
- How do I implement chaincode?
- What dependencies exist?
- What are the major functions?
- How do I pass different values to my arguments?
- How do I securely enroll a user on my network?
- How do I compile my chaincode?
- How do I interact with my chaincode through the REST API?

[https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain\\_tutorials.html#hellocc](https://console.ng.bluemix.net/docs/services/blockchain/ibmblockchain_tutorials.html#hellocc)

# Learn Chaincode

---

A tutorial to get you started with writing smart contracts for Hyperledger.

## Deployment

---

In order to support multiple versions of the Hyperledger fabric, this repository uses branches in combination with gopkg.in URLs. What does this mean for beginners? Just pick the branch below and use the instructions for that branch to complete the tutorial

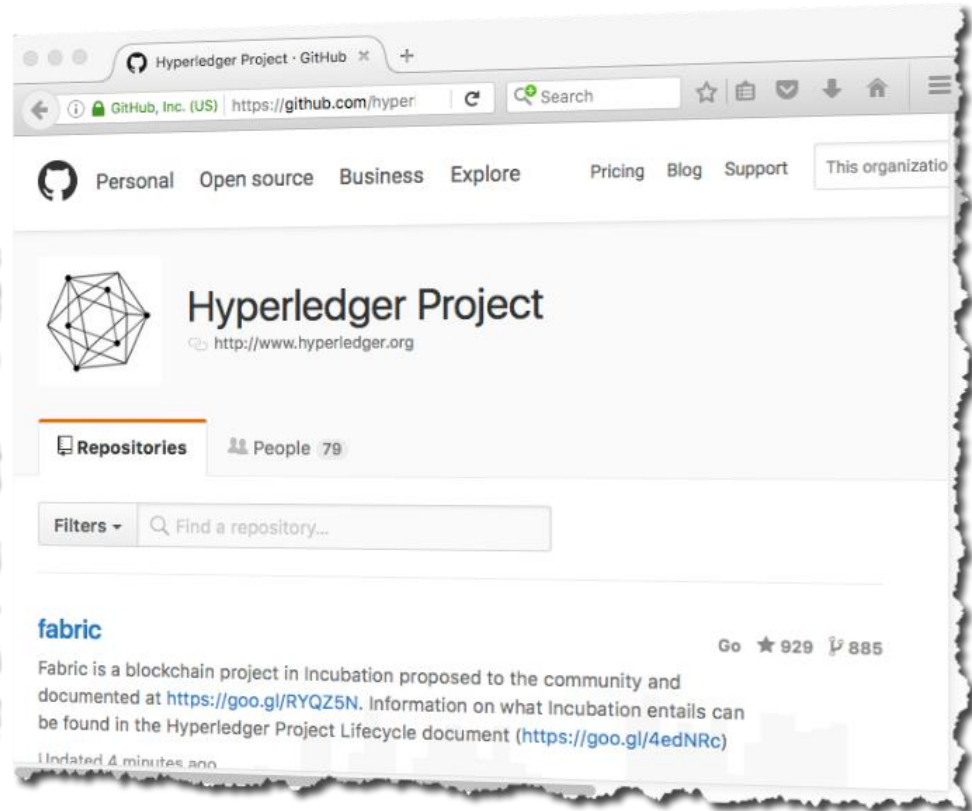
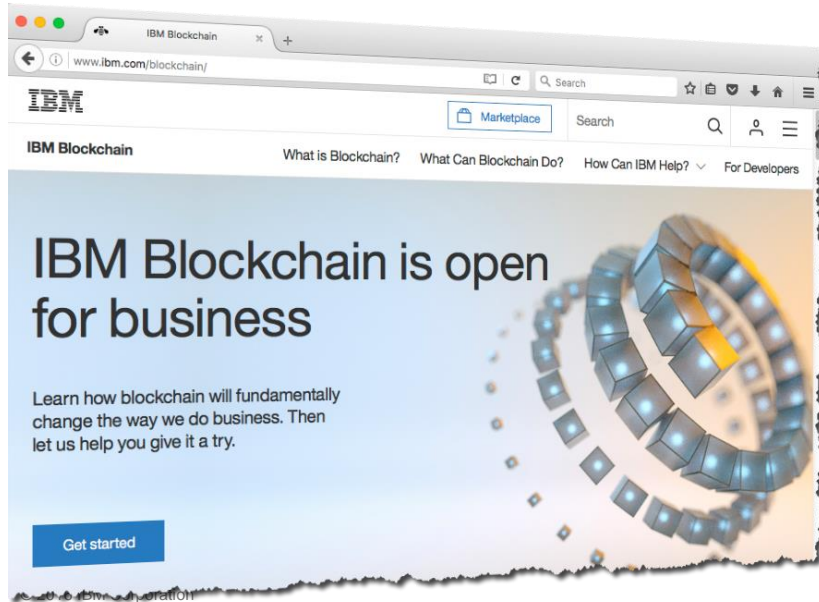
<https://github.com/IBM-Blockchain/learn-chaincode/blob/master/README.md>



# Educate Yourself!

- Everything is available through the web:

- <http://hyperledger.org>
- <https://github.com/hyperledger>
- <http://ibm.com/blockchain>



---

# Thank You!

This presentation <https://ibm.biz/BdsX6vsXmj>

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Syed Zaidi [szaidi@us.ibm.com](mailto:szaidi@us.ibm.com)

---

# Backups

---

# Blockchain intro

<https://www.ibm.com/developerworks/cloud/library/cl-blockchain-basics-intro-bluemix-trs/index.html>

<https://www.ibm.com/developerworks/cloud/library/cl-ibm-blockchain-101-quick-start-guide-for-developers-bluemix-trs/index.html> **IBM Blockchain 101: Quick-start guide for developers**