

---

# TechWatch Report – Blockchain Frameworks

**Date:** March 2018

**Contributors:** Hemant Sachdeva, Subhrojit Nag

## Contents

1	Objective .....	3
2	Capabilities .....	3
2.1	Consensus and Incentive Mechanism.....	3
2.2	Limitation and flexibility (Store data stream, Create Smart contracts) .....	4
2.3	Digital Assets.....	4
2.4	Permissioned .....	4
2.5	Security .....	5
2.6	Scalability (block size restriction, if any) .....	5
3	Ease of Adoption .....	6
3.1	Support and Documentation .....	6
3.2	Number of ways to access the blockchain platform .....	6
3.3	Platform-specific knowledge is required or not .....	6
3.4	Open Source.....	7
3.5	Deployment.....	7
3.6	Github projects .....	7
3.7	Private/test/Public network (testnet available) .....	8
4	Blockchain Frameworks .....	8
4.1	Bitcoin .....	8
4.2	Ethereum .....	9
4.3	Multichain .....	10
4.4	Hyperledger Fabric .....	11
5	Summary.....	11
6	References .....	12

## 1 Objective

Blockchain is an ingenious invention which has evolved into something extraordinary allowing digital information to be distributed but not copied. It was originally devised for the digital currency Bitcoin, which currently is the world's most popular and successful crypto currency. However, in recent times we have seen a surge of other blockchain platforms each promising to be the better than the rest. Anyone looking to build a new blockchain application essentially needs to understand the offerings of each platform. In this tech watch, we have attempted to do a comparison between few popular blockchain frameworks highlighting the defining features and limitations of each.

We have analyzed the frameworks for a set of features and have presented a graphical view of capability vs ease of adoption.

## 2 Capabilities

### 2.1 Consensus and Incentive Mechanism

#### What this means?

As a central feature of a blockchain's design, the cost of consensus (for example, computational power, energy or time), the difficulty of consensus (for example, is it random or probabilistic?) and whether the difficulty can be changed were carefully considered. Whether an incentive was in place to encourage participation in the consensus decision was also studied, although not all consensus mechanisms require an incentive mechanism.

#### How did we rate this?

The rating was based on the extent of the flexibility offered by the platform for the consensus and incentive mechanism, 1 being the lowest and 3 being the highest.

Rating	Criteria
1	There is no way to control consensus and incentive mechanism.
2	Some of the parameters can be controlled for the consensus and incentive mechanism. For example, change the difficulty level of consensus through configuration.
3	Most of the parameters can be controlled for the consensus and incentive mechanism. For example, platform provides an option to write a custom-based consensus algorithm.

## 2.2 Limitation and flexibility (Store data stream, Create Smart contracts)

### What this means?

While most of the blockchain platforms are intended for certain tasks, in this report we have tried to evaluate how generic or flexible the platform offering is. Flexible platforms, which can be used for many purposes, can be more useful and more profitable and are more likely to inspire innovation.

### How did we rate this?

The rating is based upon the extent of flexibility supported by the platform, 1 being the lowest and 3 being the highest.

Rating	Criteria
1	Platform can only be used for transacting a digital asset.
2	In addition to transacting a digital asset, the platform can be used as a general-purpose storage with indexing of primary key.
3	In addition to the above, the platform offers the capability to write smart contract.

## 2.3 Digital Assets

### What this means?

The currency the platform uses in terms of what it is (for example, real-world currency, Bitcoins, something else) and how the users obtain it (for example, via mining or buying it with other currencies).

### How did we rate this?

Rating	Criteria
1	Platform requires real-world currency to operate.
2	Platform does not require real-world currency.

- Rated 1, if the platform requires the real world currency to operate.
- Rated 2, if the platform does not require the real world currency.

## 2.4 Permissioned

### What this means?

Permissioned refers to the ability to assign different permissions to nodes, which restricts the contribution of node to the blockchain.

### How did we rate this?

Rating	Criteria
1	Platform supports permissioned feature.
2	Platform does not support permissioned feature.

## 2.5 Security

### What this means?

The security of each blockchain platform in terms of the security of transaction data, user anonymity and the security of the blockchain itself was considered. As blockchain is known to transact some value (monetary or otherwise) or data, the security of these transactions is a major significance to most users.

### How did we rate this?

Rating	Criteria
1	Security is low.
2	Security is medium.
3	Security is high.

## 2.6 Scalability (block size restriction, if any)

### What this means?

Scalability is measured (theoretically) through the number of transactions per second for each platform.

### How did we rate this?

Rating	Criteria
1	< 10 transactions per second (tps)
2	< 20 tps
3	<30 tps

## 3 Ease of Adoption

### 3.1 Support and Documentation

#### What this means?

The support and documentation describes the quality and quantity of documentation and online resources available to the developer of each platform. This includes the documentation related to the platform's design and features, technical implementation, tutorials and working examples. The more detailed the documentation is, the better it is considered for the platform.

#### How did we rate this?

Rating	Criteria
1	Documentation has a limited number of examples/tutorials for the platform.
2	Documentation has a lot of tutorials available to explain the concept, but no dedicated support group/forum exists for the platform.
3	Detailed documentation with a dedicated support group/forum (for example, Stack Exchange like support site) available for the platform.

### 3.2 Number of ways to access the blockchain platform

#### What this means?

The number of ways to access the blockchain platform can be described through the methods available to interact with the platform such as, libraries, RPC, REST API, GUI etc. This parameter is also indicative of how easy or difficult it is to use and learn the platform.

#### How did we rate this?

Rating	Criteria
1	Only RPC is available to interact with the blockchain platform.
2	In addition to RPC, REST APIs are also available to interact with the blockchain platform.
3	In addition to the above methods, GUI is also available to interact with the blockchain platform.

### 3.3 Platform-specific knowledge is required or not

#### What this means?

The level of platform-specific knowledge that is required to build an application using the platform. For example, writing smart contract requires learning platform-specific knowledge. Platforms that required less specific knowledge were considered more favorable.

#### How did we rate this?

Rating	Criteria
1	Platform mandates learning a platform-specific language.
2	Learning a platform-specific language is optional or not required.

### 3.4 Open Source

#### What this means?

An open-source platform allows the developer to understand the internals of the platform, collaborate and contribute to the project. Also if it is open source, one can analyze the future growth of the platform.

#### How did we rate this?

Rating	Criteria
1	Platform is not open source.
2	Platform is open source

### 3.5 Deployment

#### What this means?

Deployment describes the ease of deployment of the blockchain or the smart code (if it is supported by the platform).

#### How did we rate this?

Rating	Criteria
1	Deployment is difficult. For example, we have to install many dependent libraries, not all major OS (linux, window, MacOS) are supported. No Docker version is available.
2	Deployment is of medium difficulty.
3	Deployment is easy.

### 3.6 Github projects

#### What this means?

The number of github projects related to the platform. A longer history generally suggests the platform is better developed and a bigger community indicates that the development would continue.

**How did we rate this?**

We'll normalize (0-1) the number of github projects related to the platform among the platforms we have evaluated.

### 3.7 Private/test/Public network (testnet available)

**What this means?**

Describes whether the platform supports private/test/public networks.

**How did we rate this?**

Rating	Criteria
1	Platform only supports public network.
2	Platform supports public and test networks.
3	Platform supports all networks.

## 4 Blockchain Frameworks

List of blockchain frameworks considered for evaluation.

### 4.1 Bitcoin

Bitcoin's blockchain is essentially a distributed ledger system that records transactions conducted in the Bitcoin network. Each transaction is characterized by one or more transaction inputs (previous transactions from which the user has received Bitcoins) and one or more transaction outputs (users to send the Bitcoins to).

**Capabilities**

Consensus and Incentive Mechanism	2
Limitation and flexibility	1
Digital Assets	1
Permissioned	1
Security	1
Scalability	1

**Ease of Adoption**

Support and Documentation	3
No. of way to interact with blockchain	3
Platform-specific knowledge is required or not	2
Open Source	2
Deployment	2
Private/test/Public network	3

### Ratings

*Capabilities* : 1.17

*Ease of Adoption* : 2.5

## 4.2 Ethereum

Ethereum is a decentralized platform with a Turing- complete contracting language that allows the development of smart contracts. Smart contracts are applications that run on top of a custom built blockchain, similar to Bitcoin's. Ethereum's facility to develop smart contracts allows complex applications such as financial exchanges and insurance contracts to be executed on the distributed platform.

### Capabilities

Consensus and Incentive Mechanism	3
Limitation and flexibility	3
Digital Assets	1
Permissioned	2
Security	1
Scalability	2 (20 tpx)

### Ease of Adoption

Support and Documentation	3
No. of way to interact with blockchain	3
Platform-specific knowledge is required or not	1
Open Source	2
Deployment	3
Private/test/Public network	3

### References

## [Bitcoin and Ethereum Vs Visa and Paypal transactions per second](#)

Github Projects: <https://github.com/topics/ethereum>: **2152** results

### Ratings

*Capabilities* : 2

*Ease of Adoption*: 2.5

## 4.3 Multichain

The MultiChain technology is a platform that helps users to establish a certain private blockchain that can be used by the organizations for financial transactions. A simple API and a command-line interface are what MultiChain provides us. This helps to preserve and set up the chain.

### Capabilities

Consensus and Incentive Mechanism	2
Limitation and flexibility	2
Digital Assets	2
Permissioned	2
Security	2
Scalability	1

### Ease of Adoption

Support and Documentation	2
No. of way to interact with blockchain	2
Platform-specific knowledge is required or not	2
Open Source	2
Deployment	2
Private/test/Public network	2

### References

Github Projects : <https://github.com/topics/ethereum> : 26 results

### Ratings

*Capabilities* : 1.83

*Ease of Adoption* : 2

## 4.4 Hyperledger Fabric

Hyperledger Fabric is one of the blockchain projects within Hyperledger which fundamentally offers all features of a regular blockchain framework such as having a ledger, use smart contracts, and is a system where the transactions are managed by the participants. But, they fundamentally differ from other frameworks since they are private and permissioned. The members of a Hyperledger Fabric network enroll through a Membership Service Provider (MSP) who are then allowed to participate in the network.

### Capabilities

Consensus and Incentive Mechanism	1 (Kafka/PBFT)
Limitation and flexibility	3
Digital Assets	2
Permissioned	2
Security	1
Scalability	3 (>1K tx/s)

### Ease of Adoption

Support and Documentation	2
No. of way to interact with blockchain	1 (API only)
Platform-specific knowledge is required or not	2 (Go)
Open Source	2
Deployment	3
Private/test/Public network	1 (?)(Since there is no public chain)

### Ratings

*Capabilities* : 1.83

*Ease of Adoption* : 1.83

## 5 Summary

Of all the platforms that have been evaluated, Ethereum was the best in terms of documentation and support, development and scalability. Although Ethereum did not have any features that particularly increased its flexibility, it also did not have any major limitations. It has also been around for longer than the other platforms and has already been used to create fully-developed applications.

The blockchain technology and the frameworks are still evolving and it would be only fair to do the same comparison sometime in the future, to give these platforms time to mature.

## 6 References

- <https://bitcoin.org/en/>
- <https://www.ethereum.org/>
- <https://hyperledger.org/projects/fabric>
- <https://www.multichain.com/>

You can download or fork sample applications used for the analysis for the blockchain frameworks:

<https://github.com/Talentica/TechWatchBlockchain>