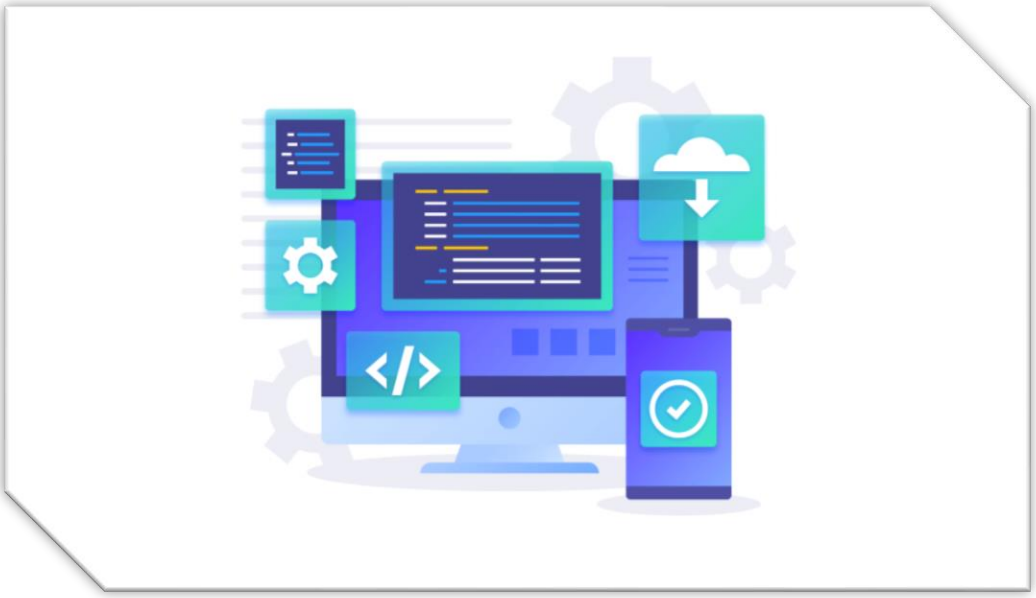
Decentralized Application (dApp) Development



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Genesis Convergence is Subject Matter Expert in Blockchain and Cryptocurrency.

We offer Crypto Development/Consulting services covering solution architecture refinement, customization, integration, transformation, visualization, and analytics to uncover insights hidden within data and enhance data exploration.

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OBJECTIVE

Decentralized applications, or dApps, have exploded in popularity during the last year. However, it is still relatively difficult to build dApps from scratch. This is why we've set up this guide for how to build dApps quickly and easily.

BLOCKCHAIN– THE NEW INDUSTRIAL REVOLUTION

In simple terms, blockchain is a peer-to-peer distributed ledger that stores information and keeps track of transactions.

- Each member of the blockchain community has its own copy of the information.
- The information is recorded subsequently into units called blocks and protected by strong cryptography, creating a chain of data.
- Changes to blocks are not permitted by the blockchain system architecture, so every action and event could be traced to its origins.
- A blockchain could store data on agreements between the parties, their credentials, transactions, and any other information presented in a digital form.
- Since this information is distributed and highly secured, any attempt at fraudulent activity can be seen by the members of the blockchain community.
- This creates trust and transparency for any type of ecosystem that the blockchain is integrated into.

Unlocking honest economy with Blockchain

Blockchain is a platform that ensures the integrity of the information stored and maintains interactions between the members of the ecosystem. Here's a high-level overview of the way it works:

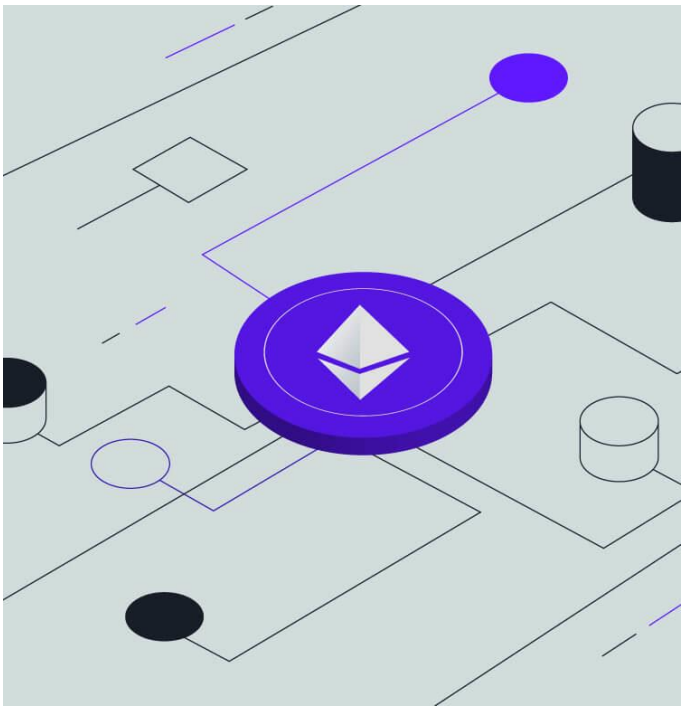
- Each member maintains their own blockchain node with the full history of all the events and data appended to the network, including credentials, identities, certificates, etc.
- Every update to the network entails the creation of a new block at the end of the chain. A blockchain protocol dictates how these blocks are recorded, validated, and distributed.
- A consensus mechanism is employed to verify each created block where members of the blockchain network decide if it's valid to be added to the chain.
- Once a block is created and confirmed, it cannot be revoked. All entries on the blockchain are permanent and securely stored. This allows for members of the community to trace the full history of transactions and any other modifications in the7i blockchain.

- Smart contracts are a special type of agreement between the members of the network that have the conditions programmed into them, making sure that they are met before each party receives what was agreed upon. Smart contracts eliminate the need for third parties and middlemen to be involved in agreement resolution.
- Transactions in cryptocurrency play a very important part in the blockchain ecosystem, providing the incentive for all members of the community to make valuable contributions and participate in the development of the system as a whole.

These key pillars of blockchain technology lay the foundation for its uses throughout different industries, including in education. It has the potential to create a global environment where learning materials, publications, student credits, and transcripts are easily accessible. It can also introduce new and innovative ways for accountability, incentivization, and communication between teachers, students, and other participants.

WHAT ARE DECENTRALIZED APPLICATIONS - DAPPS?

DApps or decentralized applications, are open-source applications that are used to interact with smart contracts (ex. tokens) that run on a peer-to-peer network of servers.



- These applications can be based on a variety of blockchain platforms such as Ethereum, EOS, Hyperledger, Polkadot, and others.
- Since dApps don't rely on central servers, this vastly reduces the risk of failure, making them more reliable than traditional applications.
- By eliminating the middleman between users and service providers, dApps allow for greater freedom, openness and transparency but also reduce the risks associated with handling user data.
- Due to their nature, developing a dApp is a rigorous process that requires a lot of attention and care. Once a dApp (and the underlying smart contracts) is deployed, it is difficult to introduce fixes and major updates. For this reason, it is important that your dApp is developed professionally.

DApp Frontend

The frontend code which is executed on the user side looks like any modern mobile application. However, it contains a digital wallet which:

- Contains a record of the user's private and public keys for authentication
- Interacts with the blockchain to manage the cryptographic keys and the blockchain addresses
- Triggers the backend (smart contracts) to be executed

DApp Backend

The backend code (smart contract) which runs on the server side of the application has the following characteristics:

- It is stored and executed on a blockchain
- It is open source
- Performs the same function irrespective of the environment of execution

DAPP KEY FEATURES

Now that you have a general idea about DApps, let's get more specific and dive into the key features that actually constitute them.

Open Source.

A DApp has to be open-source, with no single entity controlling it. It must be autonomous and the code has to be available for inspection.

Decentralized

Its operational records have to be stored on a decentralized blockchain.

Incentivized

It must be able to generate tokens as proof of value and distribute these tokens as rewards on the network.

Protocol-compliant

DApp's stakeholders must agree on a cryptographic algorithm to show proof of value. For example, both Bitcoin and Ethereum currently use Proof of Work as their consensus protocols. However, the latter is planning to shift to Proof of Stake in the next few years.

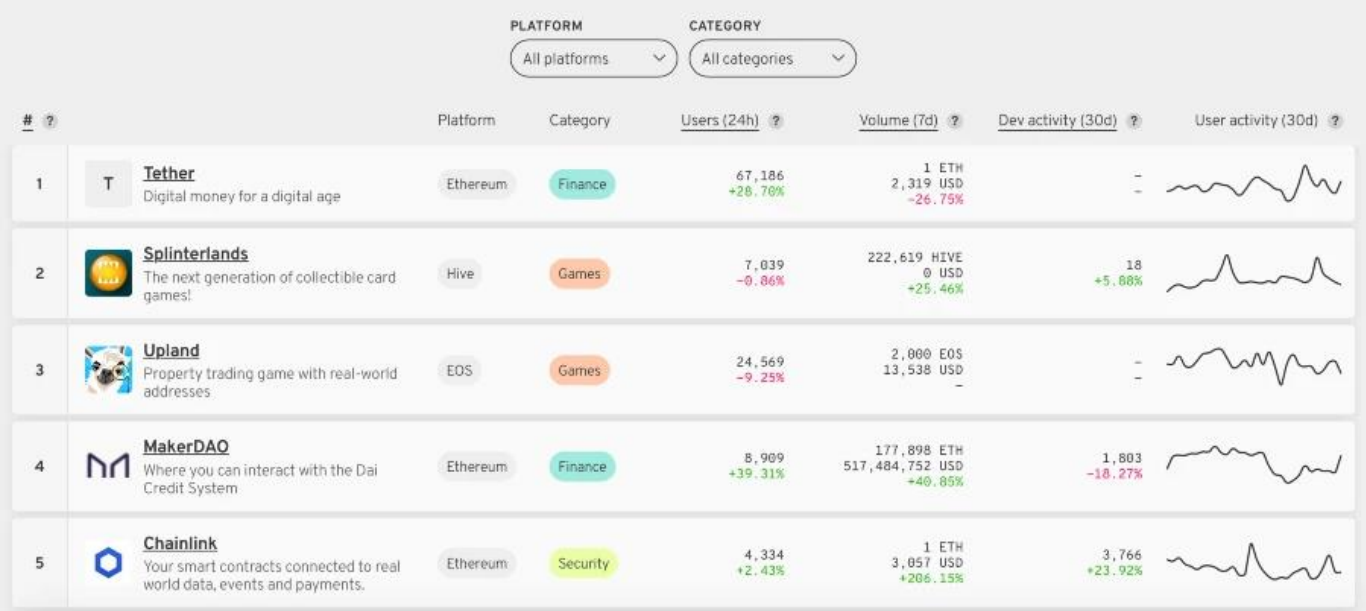
To summarize, end users may not even distinguish DApps from traditional applications since the main differences are found in the underlying blockchain protocol.

EXAMPLES OF DECENTRALIZED APPS

Naturally, before starting your own DApp development, it's good to see what's already out there. State of the DApps is an excellent resource that provides data and statistics on everything concerning decentralized applications.

- At the time of writing, three out of five top-ranked DApps are Ethereum-built. Two out of five are from the games category, while another two are in finance.
- The top of the ranking belongs to Tether, a cryptocurrency whose tokens are backed by an equal amount of fiat currencies. Unsurprisingly, it is an Ethereum DApp that boasts over 67,000 daily active users.
- The second and third spots are occupied by Splinterlands and Upland, respectively. Both are in the gaming category and are built on different platforms — Hive and EOS.

- Clearly, Ethereum DApps are in the majority. In terms of predominant sectors — finance and gaming apps fight for the first spot.

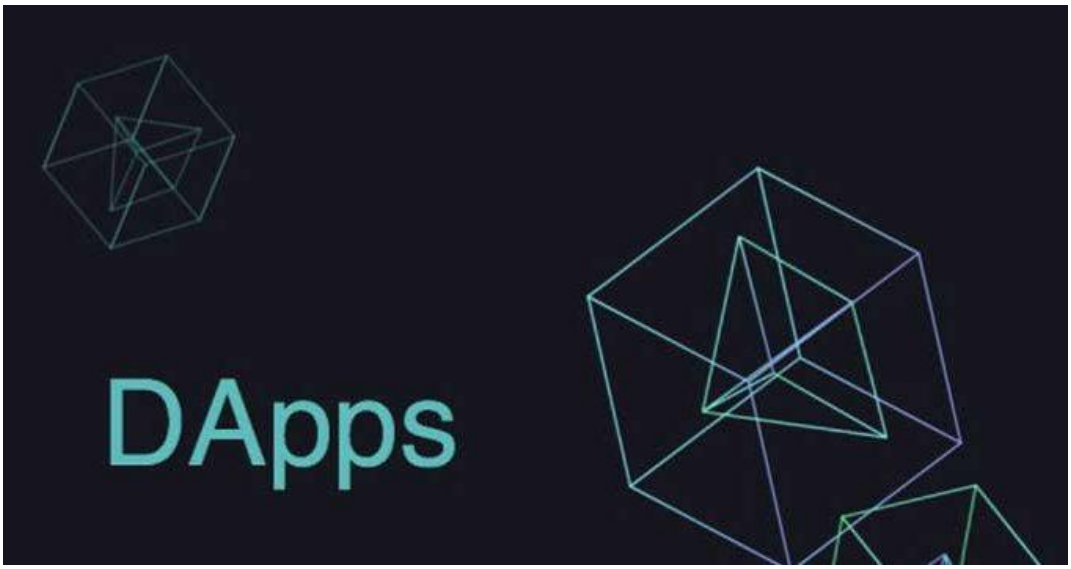


PLATFORM: All platforms | CATEGORY: All categories

#		Platform	Category	Users (24h)	Volume (7d)	Dev activity (30d)	User activity (30d)
1	**Tether** Digital money for a digital age	Ethereum	Finance	67,186 +28.70%	1 ETH 2,319 USD -26.75%	- -	
2	**Splinterlands** The next generation of collectible card games!	Hive	Games	7,039 -0.86%	222,619 HIVE 0 USD +25.46%	18 +5.88%	
3	**Upland** Property trading game with real-world addresses	EOS	Games	24,569 -9.25%	2,000 EOS 13,538 USD -	- -	
4	**MakerDAO** Where you can interact with the Dai Credit System	Ethereum	Finance	8,909 +39.31%	177,898 ETH 517,484,752 USD +40.85%	1,803 -18.27%	
5	**Chainlink** Your smart contracts connected to real world data, events and payments.	Ethereum	Security	4,334 +2.43%	1 ETH 3,057 USD +206.15%	3,766 +23.92%	

BENEFITS OF DAPP DEVELOPMENT FOR YOUR BUSINESS

Just like any traditional app, a dApp's purpose is to offer a service to users and resolve a problem. But unlike traditional apps, dApps offer a variety of further benefits that set them apart:



Automation

Decentralized applications are powered by smart contracts – self-executing contracts written in code that provide automation.
This can drastically reduce transaction costs and enable frictionless peer-to-peer transactions. It also reduces costs associated with employees, auditors, legal advisors, etc.

Transparency

DApp data is stored on a so-called public ledger that records everything in a secure and transparent way that guarantees that no one can manipulate it.
This creates openness and transparency, and eliminates the need for middlemen when it comes to connecting to your customers

Privacy

The use of a blockchain eliminates the need for users to create accounts. The dApp recognizes users using blockchain validated cryptography. This facilitates greater privacy and ease of use

User-governance and autonomy

Due to their decentralized nature, dApps function on the basis of consensus by all users which guarantees that no one can dominate and act as a gatekeeper.

This includes consensus about the cryptographic algorithm that is used to show proof of value. Consensus is also required when any changes are made to the code of the dApp itself.

Open-source

Being open-source, dApps' code is open for review. This allows the whole ecosystem to be more flexible, to progress faster and to be developed more securely because more input can be provided.

Fault-tolerance

Because dApps are decentralized, rather than based on standard client/server networks, no single node controls all the transactions or records. In other words, there is no single point of failure that can crash or sabotage the whole app.

As a result, dApps are both more stable and safer than traditional apps, do not need downtime and provide constant access.

Incentivization

DApps have an incentivization mechanism in the form of tokens or digital assets. Tokens are used to incentivize validators of the blockchain or as "bug bounties".
These benefits both the developer community as well as users, and guarantees greater engagement and interest in the dApp.

THE DAPP DEVELOPMENT PROCESS

Developing a dApp goes through several steps to ensure that the final product serves the targeted use case. When developing dApps, cognitive convergence can use the following programming languages, frameworks, and blockchain protocols:

Programming languages: JavaScript, TypeScript, Go, Solidity, Node.js
Frameworks: Angular, React, React-Native, Ionic
Blockchain Protocols: Ethereum, EOS, Hyperledger
The dApps development process goes through the following phases:

Business & technical analysis

The fist step involves an analysis of the business use case of the dApp. This includes gaining a detailed understanding of the purpose of the app, and how it will solve the problem it will be designed for.
Once the root cause on a business level has been identified, a technical analysis is conducted to map out how blockchain can help resolve the problem, and what platform should be used for the purpose. If you are already certain about how you wish the dApp to be developed, at this stage we'll analyze your plan to determine if there are any improvements or changes that need to be made.

Architecture design

When the use case has been determined, an initial design of the dApp architecture is conducted. The purpose of this design is to create a proof of concept (POC), and demonstrate how all of the parts of the dApp will fit together. The architectural design also includes a plan on how the frontend layer, the user interface, and the backend layer – smart contracts, storage, and blockchain – will interact with each other.

Low- and high-fidelity designs

After the architecture of the dApp has been agreed upon, both low and high-fidelity design prototypes are created. Fidelity design includes elements such as visual design, content, and interactivity. The initial low-fidelity design is used to further flesh out how the app will look and work. After fleshing out these aspects of the app, a high-fidelity design is created that results in a clickable prototype.

Development of smart contracts / wallets

The next step involves the creation of smart contracts which will connect the dApp to the blockchain and execute the business logic and functionality of the app. Wallets are also developed at this stage to enable the exchange of tokens within the dApp.

Backend / frontend development

At this stage, the fidelity designs are moved to the development stage and the frontend and backend are finalized. The frontend can be created in any programming language that can make API calls to the backend.

Internal audit

An internal audit is conducted to review the previous development stages and establish if all requirements and specifications have been met. During the audit, tests are also conducted to check how the various parts of the dApp work together.

Test net deployment

After the audit is completed, and any potential issues have been identified and resolved, the dApp is deployed in a test net. The test net deployment allows developers and clients to test the dApp at no cost, and to evaluate if the dApp works as planned.

Main net deployment

The dApp is deployed on the main net on which it will function and becomes available to users.

TYPES OF DAPPS

There are three distinct types of dApps, usually called Type I, II, and III.

Type I dApps

These types of dApps have their blockchain. This includes Bitcoin, Litecoin, and other types of altcoins.

Type II dApps

These dApps use the blockchain of type I. They are protocols with tokens that keep them functioning. They may act as a layer on top of the blockchain that offers certain functionalities.

Type III dApps

These types of dApps have their Type III dApps use the protocol of type II, and also have tokens that are necessary for them to function.

PROS AND CONS

Pros

Since decentralized applications are not owned by an individual or a company, and are deployed on distributed systems, they have the following features:

- Points of failure:
  - DApp: No single point of failure because individual users' machines don't rely on a single central server to handle processes
  - Centralized app: Single (or fewer) point(s) of failure: if the centralized server fails, the application network goes offline and no one can use the application until the error is fixed
- Data security:
  - Security issues due to centralized data storage: If the server is hacked, all stored data about users like photos, videos, texts, or personal information can be leaked.
  - DApp: User privacy: Users don't have to provide real identities to create or interact with DApps
  - Users information is stored on a shared database which no authority has control over.
  - Information can only be decrypted by the user.
- Costs:
  - Centralized apps tend to have higher costs. Applications such as YouTube take a percentage of the user's profit from their posted videos to compensate for data processing and marketing costs.
  - DApps can be more financially efficient since they can function without a middleman to take profits from transactions. Users can transact directly using cryptocurrency.
- Content guidelines:
  - Centralized apps follow both laws and regulations of their country as well their own arbitrarily decided Terms & Conditions in deciding which content to publish. For example,
  - Youtube was documented to publish ads of well known brands in videos including hate speech
  - Tiktok was accused of censoring transgender users
  - DApps have no central authority exercising censorship. Users cannot be blocked from submitting transactions, deploying DApps, or reading data from the blockchain. So users are responsible for legal and regulatory implications for the content they share or consume.

Cons

- Difficult to maintain: Once a DApp code is deployed on a blockchain it cannot be taken down or manipulated with, therefore ,it is difficult for developers to make updates or fix bugs in their DApps.
- Difficult KYC process: Since users don't have to provide real identities to deploy or interact with DApps, verifying customer identities is challenging.
- Network congestion: Current DApp networks can process 10-15 transactions per second. If one DApp uses too many computational resources, the entire network gets congested.

CONCLUSION

DApp development is still in its early stages. However, we are already seeing DApps being used in financial services, gaming, logistics, and other sectors. It is only a matter of time until they become mainstream as enterprises seek ways to streamline processes and enhance security. Now, it's important not to fall behind. If you want to stay on top of digital innovation and begin leveraging blockchain-based technologies — don't hesitate to reach out.

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