



Peer-to-Peer Architecture – Part 1

In this lesson, which is part one of the discussion about peer-to-peer architecture, we will take a deep dive into the architecture and discuss it in detail.

We'll cover the following



- What is a peer-to-peer network?
- What does a central server mean?
- Downsides of centralized systems
- What is a decentralized architecture?
- Advantages of a peer-to-peer network

Peer-to-peer (P2P) architecture is the base of *blockchain* tech. We've all used it at some point in our lives to download files via *torrent*. So, I guess you have a little idea of what it is. You are also probably familiar with terms like *seeding*, *leeching*, etc. Even if you aren't, you'll learn everything in this lesson.

Let's begin the lesson with a discussion of what a *P2P* network is.

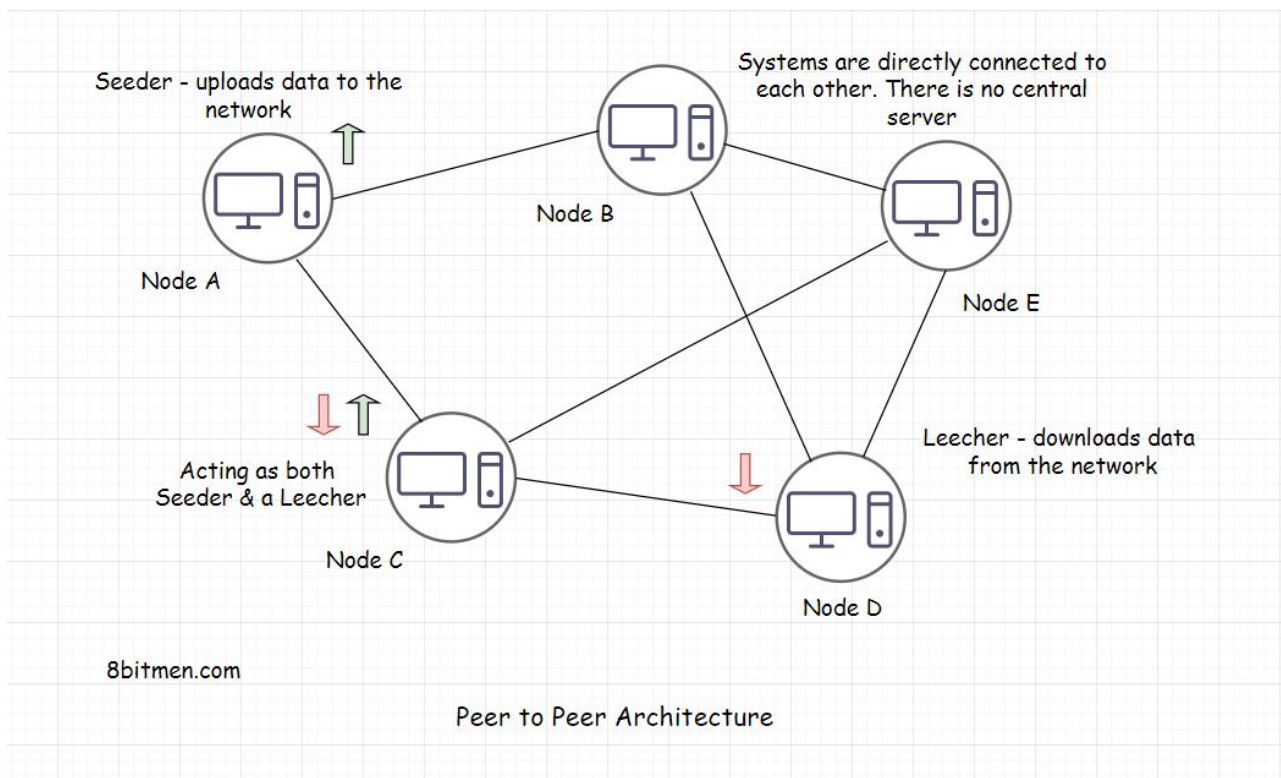
What is a peer-to-peer network?#

A *P2P* network is a network in which computers, also known as *nodes*, can communicate with each other without a central server. The absence of

can communicate with each other without a central server. The absence of a central server rules out the possibility of a single point of failure. All the

computers in the network have equal rights. A *node* acts as a *seeder* and a *leecher* at the same time. So, even if some of the computers/nodes go down, the network and the communication is still up.

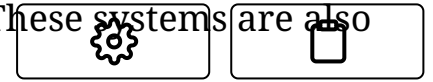
A *seeder* is a *node* that hosts the data on its system and provides bandwidth to upload the data to the network, and a *leecher* is a node that downloads the data from the network.



What does a central server mean?#

I want you to think of a messaging app. When two users communicate, the first user sends a message from their device, and the message moves on the server of the organization hosting the messaging service. From there, the message is routed to the destination, that is, the device of the user receiving the message.

The server of the organization is the *central server*. These systems are also known as *centralized systems*.



Okay, so what's the issue when communicating with my friend via a central server? I have never faced any issues.

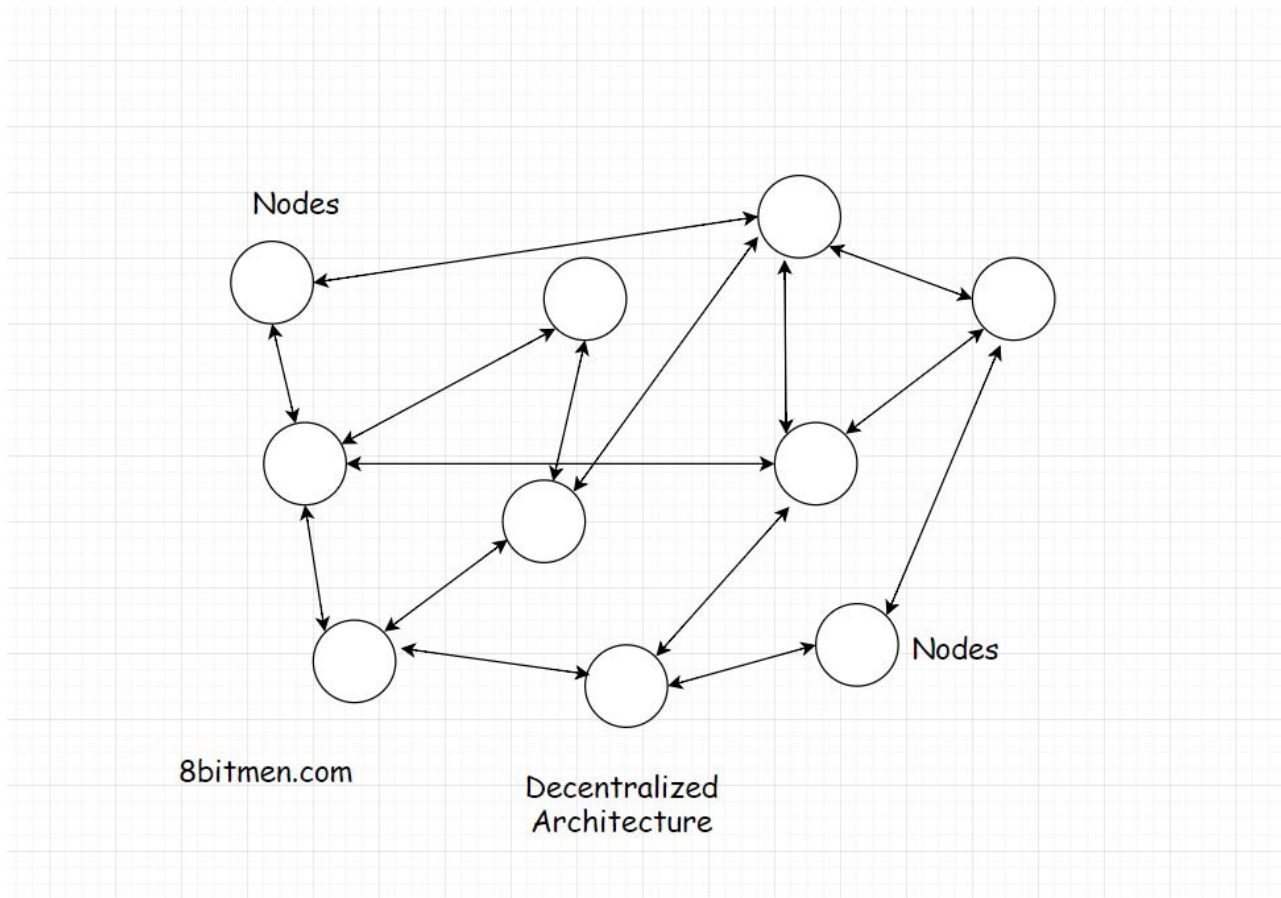
Downsides of centralized systems#

In this scenario, there are a few important things to consider:

- First, the *central server* has access to all your messages. It can read them, share them with its associates, laugh about them, and so on. So, communication is not really secure. Even though the businesses say that the entire message pipeline is encrypted and stuff, data breaches still happen, governments get access to our data, and data is sold to third parties for fat profits. Do you think these messaging apps are really secure? Should the national security or enterprise officials sitting at the top of the food chain use these central server messaging apps for communication?
- Second, in case of events like a natural disaster, earthquake, a zombie attack, massive infrastructural failure, or the organization going out of business, we are stranded. There is no way to communicate with our friends across the globe. Think about it.
- Third, let's say you start creating content on social media. You have a pretty solid following on it, you spend 100+ hours a week to put out the best content ever, and you have worked years to reach this point of success. Then one fine day, out of the blue, the organization pokes you and says, "Hey!! Good job, but, aaaaa... for some reason, which we can't talk about, we have to let your data go. We just don't like your content." *Shift + Del* and whoosh... all your data disappears like a genie. *What are you going to do next?* If you are already a content

creator or are active on social media, this happens all the time, and you know that.

Fortunately, P2P networks are resilient to all these scenarios, due to their design. They have a *decentralized architecture*.



What is a decentralized architecture?#

Nobody has control over your data, and nobody has the power to delete your data because all the participating nodes in a *P2P* network have equal rights. During a zombie apocalypse, when the huge corporation servers are dead or on fire, we can still communicate with each other via a *peer-to-peer* connection.

Though I've nothing against any of the corporations :) They've made our lives really easy. It's just I am making you aware of all the possible

scenarios out there.



Advantages of a peer-to-peer network#

Here is another use case where a peer to peer network rocks!!

Imagine this, you have finally returned home from a trekking tour after visiting all seven continents around the world. Things couldn't seem more beautiful or be more emotionally satisfying.

You have documented the entire expedition with state-of-the-art cameras and equipment in super ultra HD 4K quality, which has stacked up the hard drive of your computer. You are super excited to share all the videos and photos of the tour with your friends.



But how do you really plan to share the data, which is several gigabytes, with your friends?

Facebook Messenger, WhatsApp?

Messengers have a memory limit, so they aren't even an option. Well, you could upload all the stuff on the cloud and share the link with your folks, but, hold on. Uploading that much data needs some serious storage space, and this would mean some serious money. Would you be in the mood of spending anymore after such a long trip?

No problem. We can write all the files on a physical memory like a DVD or a portable hard drive and share them with our friends, right?

Well yes, we can. However, physical memory has its costs, and writing files for every friend is time-consuming, expensive, and resource intensive. I get it you are tired already. But, oh!! By the way, we have to courier the disks to friends located across the globe, adding additional courier expense and delaying the time it will take to reach them.

We've got this, so don't worry!! We'll find out some way.  now what 

options do we have remaining? Think about it.

Hey, why don't we use *peer-to-peer* file sharing? That would be awesome.

With *P2P peer-to-peer* file sharing, we can easily share all the content with friends with minimal costs and fuss.

Beautiful!!

We can use a *P2P* protocol like *BitTorrent* for it. BitTorrent is the most commonly used *P2P* protocol for distributing data and large electronic files over the internet. It has approx. 25 million concurrent users at any point in time.

So, we will create a *torrent* file of our data, and share it with all our folks. They just have to put the *torrent* in their BitTorrent client and start downloading the files to their systems while hosting/seeding the files simultaneously for others to download.

These are a few of the use cases where the *P2P* network rocks. In the next lesson, which is the second part of the *P2P* architecture section, we will take a deep dive into the architecture.

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