

Towards **decentralized** p2p storage as a  
**secure** and **sustainable** alternative to  
centralized **cloud storage** solutions

7th edition of the Workshop  
Performance and Scalability of Storage  
Systems



# THE 2022 ONLINE BIG DATA FACTS

# The importance of data today



5.4b

people online



1.9b

total websites



500m

Tweets sent daily



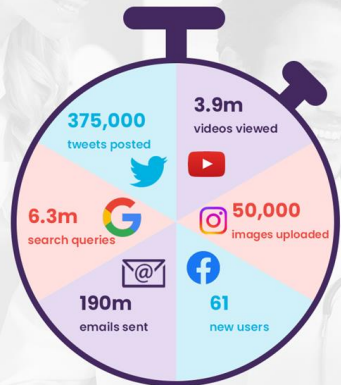
183b

emails sent daily

## HOW MUCH DATA IS OUT THERE?

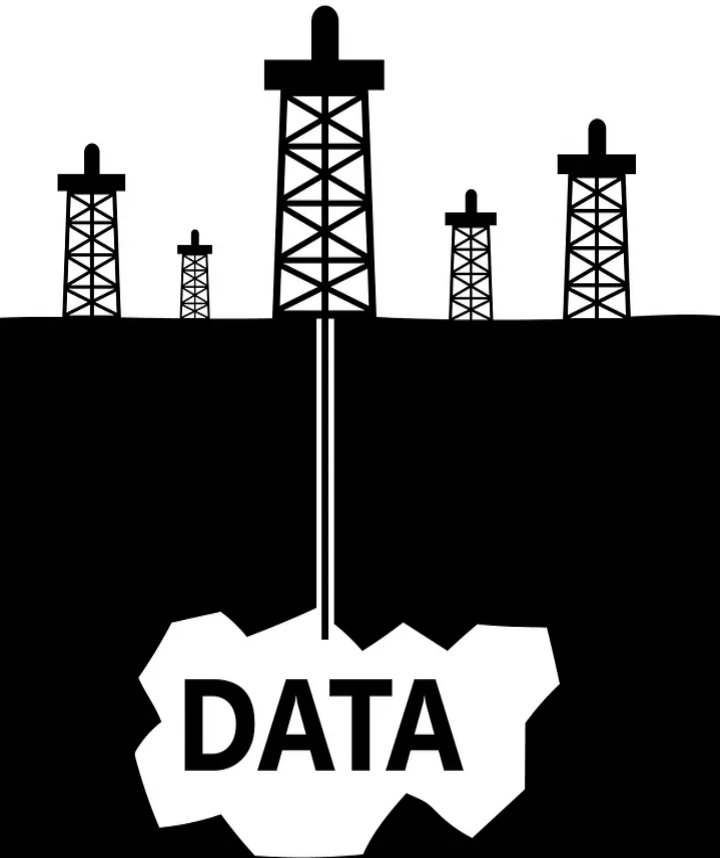
World data is predicted to reach **1752B** by 2025.  
That much data would take one person **1.8 billion years** to download at current internet speeds!

## WHAT HAPPENS ONLINE EVERY MINUTE?



Big tech companies have been collecting data for a long

Year after year new regulations about the use of data are created.



# Data is the new oil



- In 2017 The Economist published an article entitled "The world's most valuable resource is no longer oil, but data."

- Data has to be refined before used
- Data is an infinite resource
- Data can be reused without losing its quality.
- Data is not always available to everyone

Turn data into information and  
turn information into insight



# Data storage today

## The cloud



**\$1+ Trillion**  
Cloud storage and compute  
market by 2028

**20%**  
Year over year  
growth

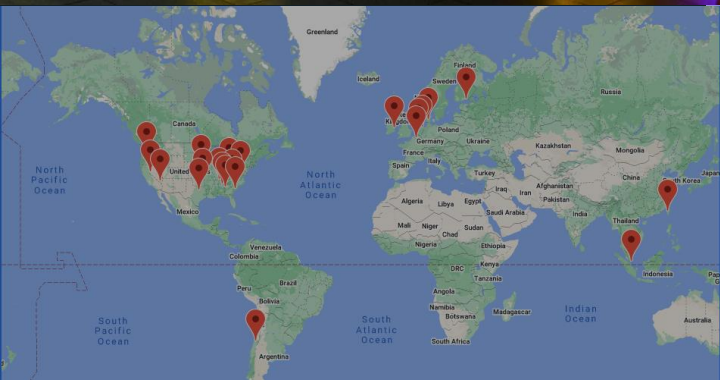
**70%**  
Storage owned  
by 3 cloud players

**58%**  
Compute owned  
by 3 players



**20+ million servers**

Centralized in large data centers (mostly US, northern EU)



# Centralized Datacenters

... Did you know ?



## Energy

**20% of electricity** demand in 2030  
**40% of which is used by:**  
generators, air conditioning, ...



## Privacy

Terms of services of major players give their employees, "trusted 3rd parties" ... permission to **access your files**, view, share, monetize for advertising, ...



## Security

**10 million DDoS** attacks got made in 2020 alone.  
**15.4** million by 2023.  
**480 Million** breached records in 2023



## Sovereignty

Countries seek to **keep** citizen's data **within** their **boundaries**

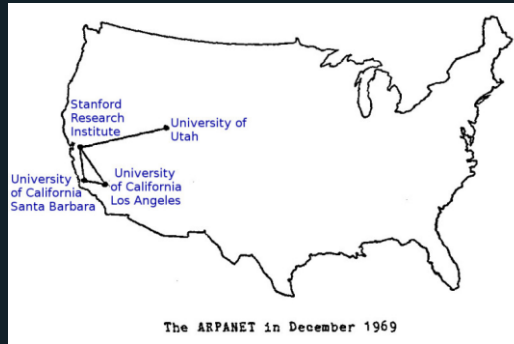


## Cloud costs

typically **~75% of costs of revenue** among software companies

# The Evolution of the Internet, From Decentralized to Centralized

Decentralization was the historical foundation of the internet






ARPANET

- The challenge was to build an **invulnerable** network, i.e. which **could neither be controlled nor be destroyed**.
- The only solution to such a problem was **decentralization**: nobody owns the internet, nobody controls the internet, nobody decides who can connect to it or what they can do once connected.

# Web 3.0 : The next big thing ?

**THE EVOLUTION OF THE INTERNET** @rare2uhair

Web 1.0	Web 2.0	Web 3.0
Works like expected No boundaries pushed 'The Standard' The spider makes its web, catches flies as expected No user input	Big Corporations Everything is Trademarked, Copyrighted, Patented Looks pretty on the outside Social media is free...but is it? Permission needed to create	Collaborate with others to reach bigger goals Community is everything Own stake, motivation to grow Not as pretty as Web 2.0 Trust on others
		

Static  
Read-only  
Simple  
Experts

Dynamic  
Read-write  
Centralized  
Big-techs

Semantic  
Read-write-execute  
Decentralized  
User control



**Web 1.0**  
"Read Only",  
Decentralized

**Web 2.0**  
Participatory,  
Centralized

**Web 3**  
No Intermediaries,  
Decentralized



# Why Decentralized storage? hive

We need an alternative!

## Distributed

Powered by the network of computing resources

## Sustainable

Consume less energy

## Private

Protect individuals data

## Secure

Zero trust principle, Secure by design

## Data sovereignty

Comply with regulatory requirements

## Affordable

Minimal cost



# What is a Decentralized storage ?

Distributed **peer-to-peer** cloud,  
federating and weaving **unused capacity** of connected  
devices

20%+

Computing  
Resources remain  
unused at the edge



users to share  
these storage and  
computing  
resources



# How does it work? HiveDisk as an example

# HiveDisk technical overview

 Upload

 Storage, Monitoring and Repair

 Download

# HiveNet



Hiver

# How does it work?

## Uploading a file

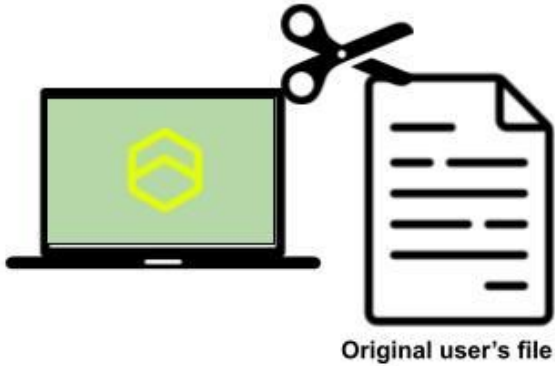


Original user's file



# How does it work?

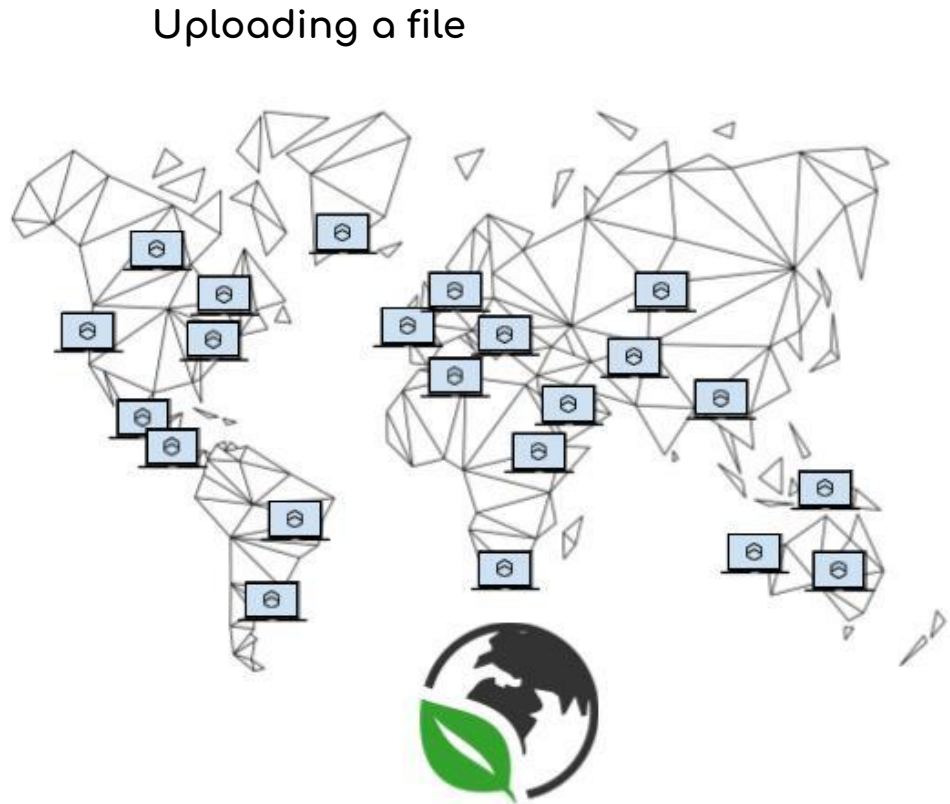
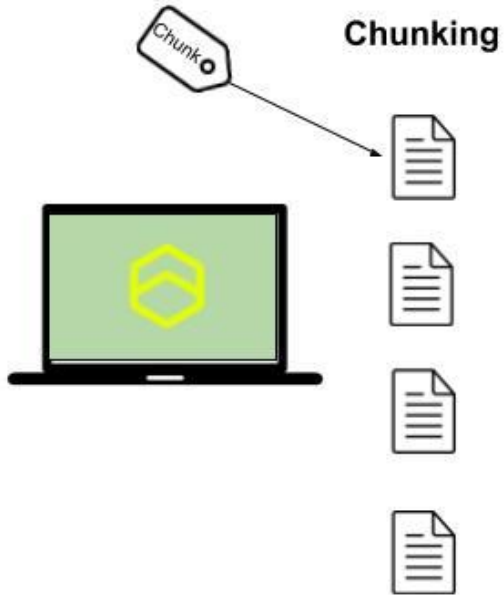
## Chunking



## Uploading a file



# How does it work?



# How does it work?

## Compression



## Uploading a file

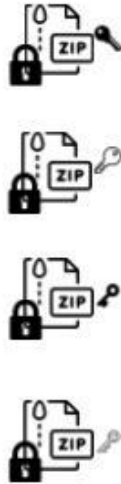




# How does it work?

## Uploading a file

### Encryption



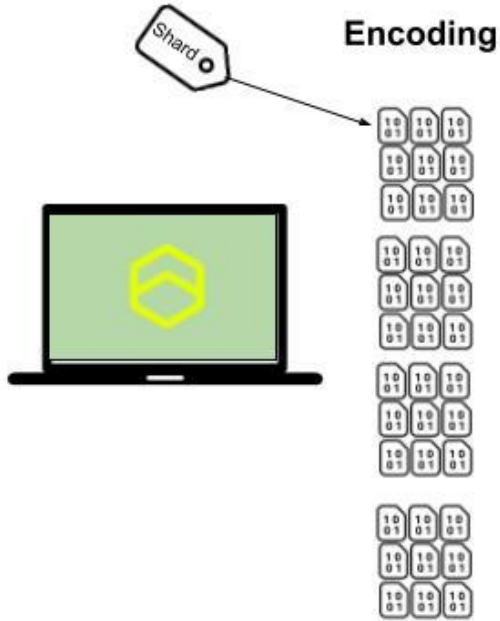
# How does it work?

## Uploading a file

### Encoding



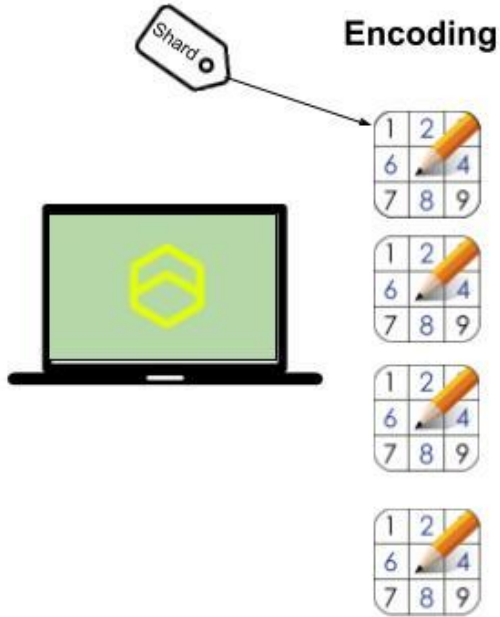
# How does it work?



## Uploading a file



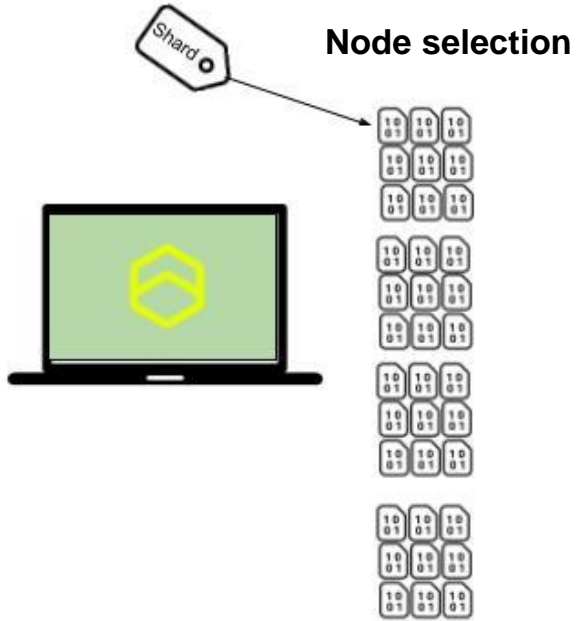
# How does it work?



## Uploading a file



# How does it work?



## Uploading a file



# How does it work?

## Node selection



## Uploading a file



# How does it work?

## Node selection



## Uploading a file



# How does it work?

## Uploading a file

### Node selection





# How does it work?

## Data dissemination



## Uploading a file



# How does it work?

## Data dissemination



## Uploading a file



# How does it work?

Data dissemination



Uploading a file



# How does it work?

Node churn



Healing the "swarm"



# How does it work?

Node churn



Healing the "swarm"



# How does it work?

Loss detection



Healing the "swarm"



# How does it work?

## Healing the "swarm"

### Collaborative repair



# How does it work?

## Healing the "swarm"

Selecting new nodes





# How does it work?

Disseminating new shards

Healing the "swarm"



# How does it work?

Disseminating new shards

Healing the "swarm"



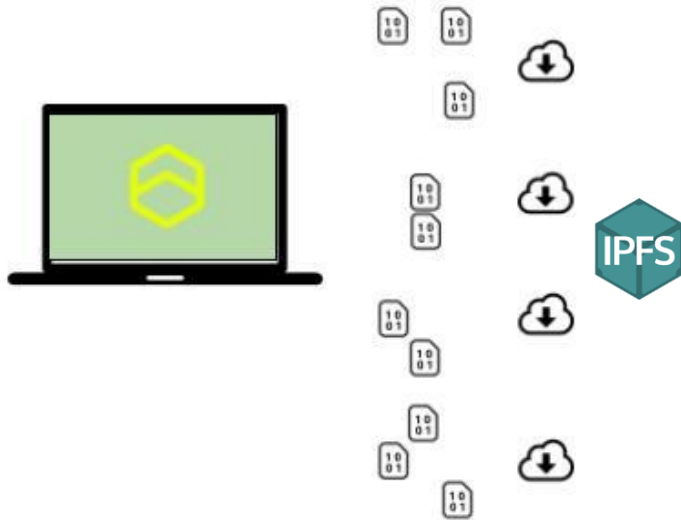
# How does it work?

## File download



# How does it work?

## Shards Download

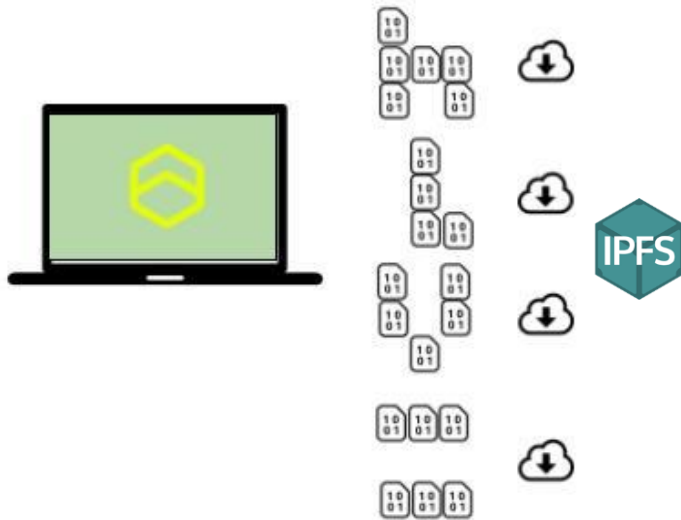


## File download



# How does it work?

## Shards Download



## File download



# How does it work?

## Chunk Decoding & Repair



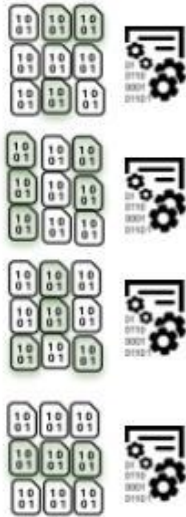
Sudoku Time

## File download



# How does it work?

## Chunk Decoding & Repair



Sudoku Time

## File download



# How does it work?

## Decryption



## File download





# How does it work?

## Decryption



## File download



# How does it work?

## Decryption



## File download



# How does it work?

## Decompression

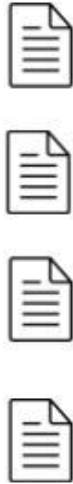


## File download



# How does it work?

## Decompression

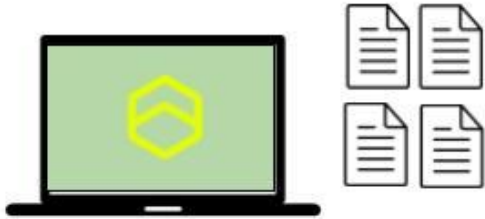


## File download



# How does it work?

## Reconstruction



## File download



# How does it work?

## Reconstruction



Original user's file

## File download



# Demo Hive filesystem



# Q&A





# Thank You!

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