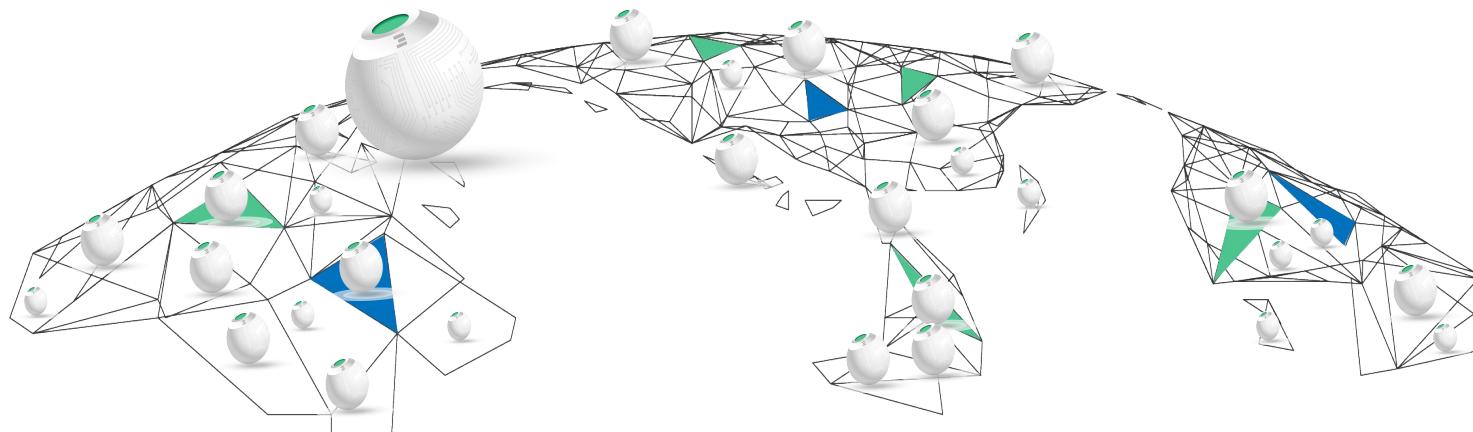
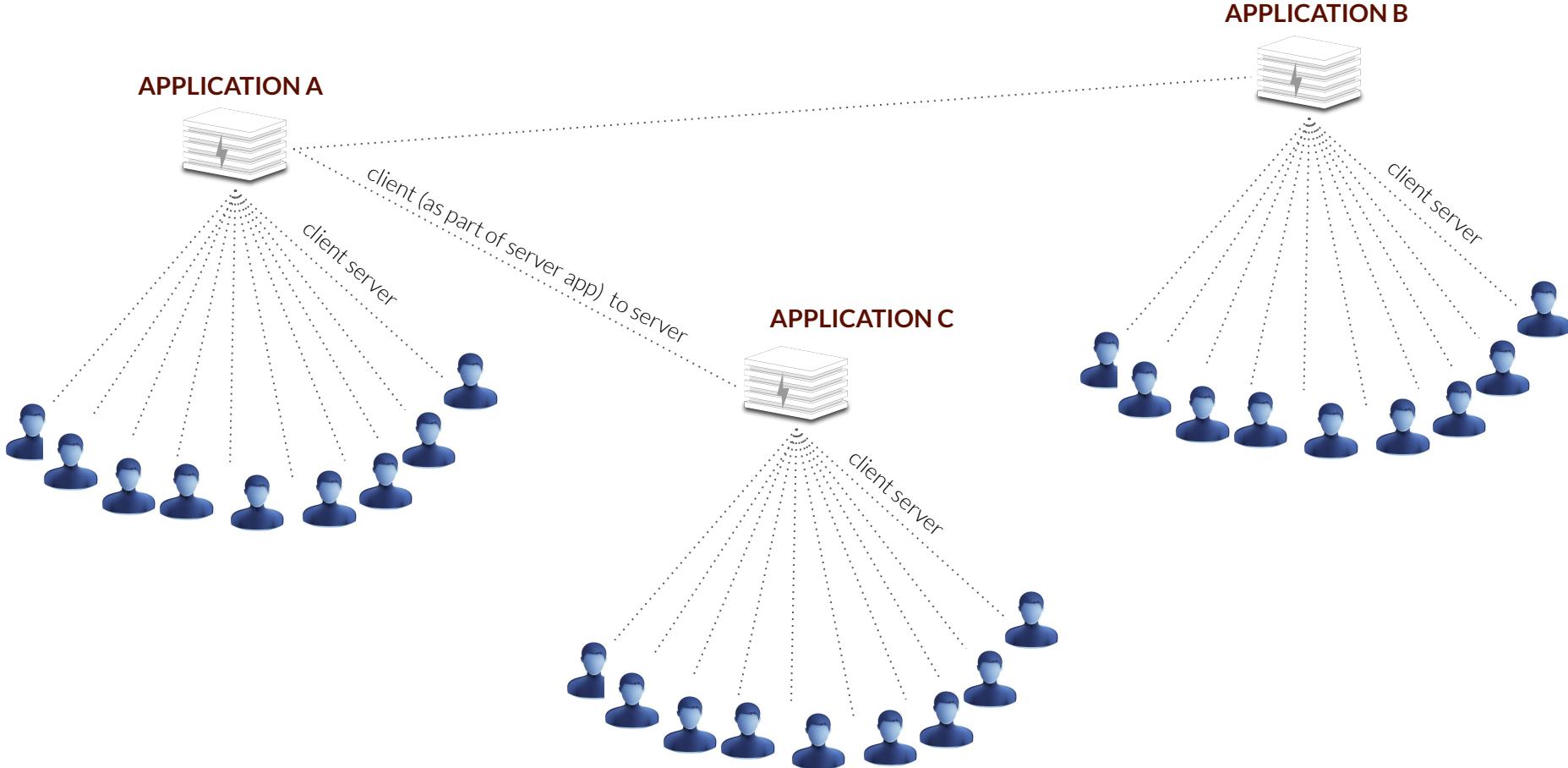




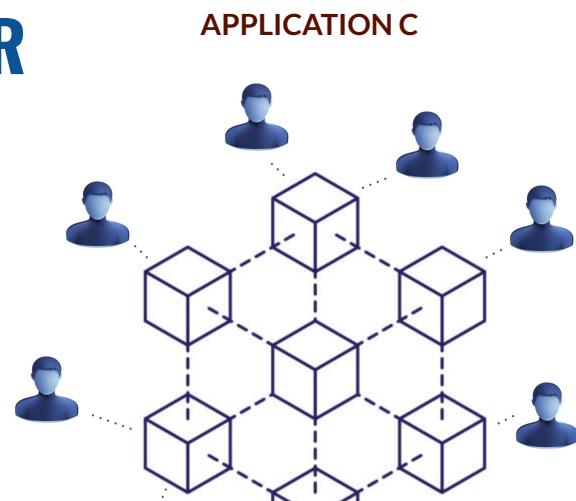
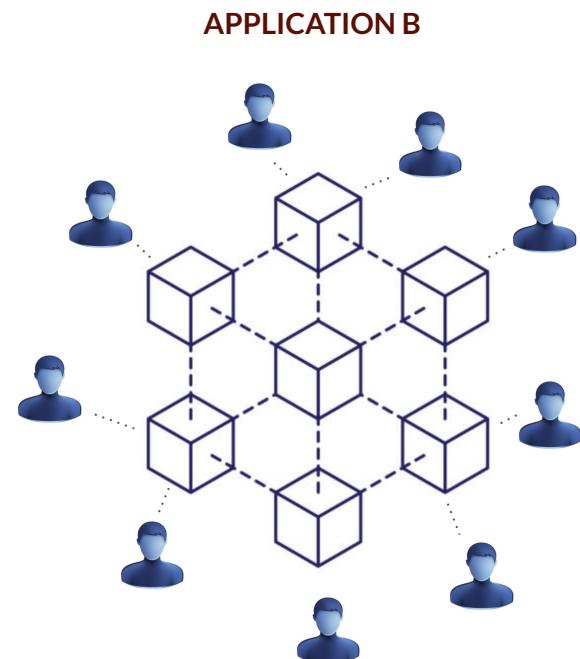
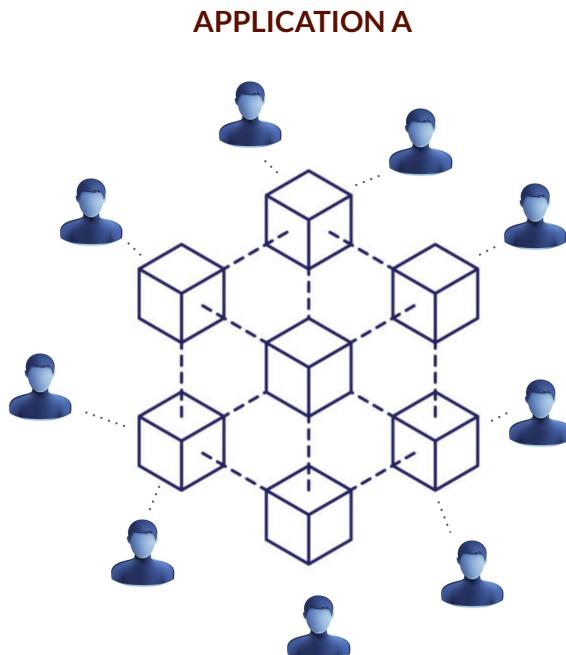
**TECHNOLOGY  
OVERVIEW  
CONFIDENTIAL**



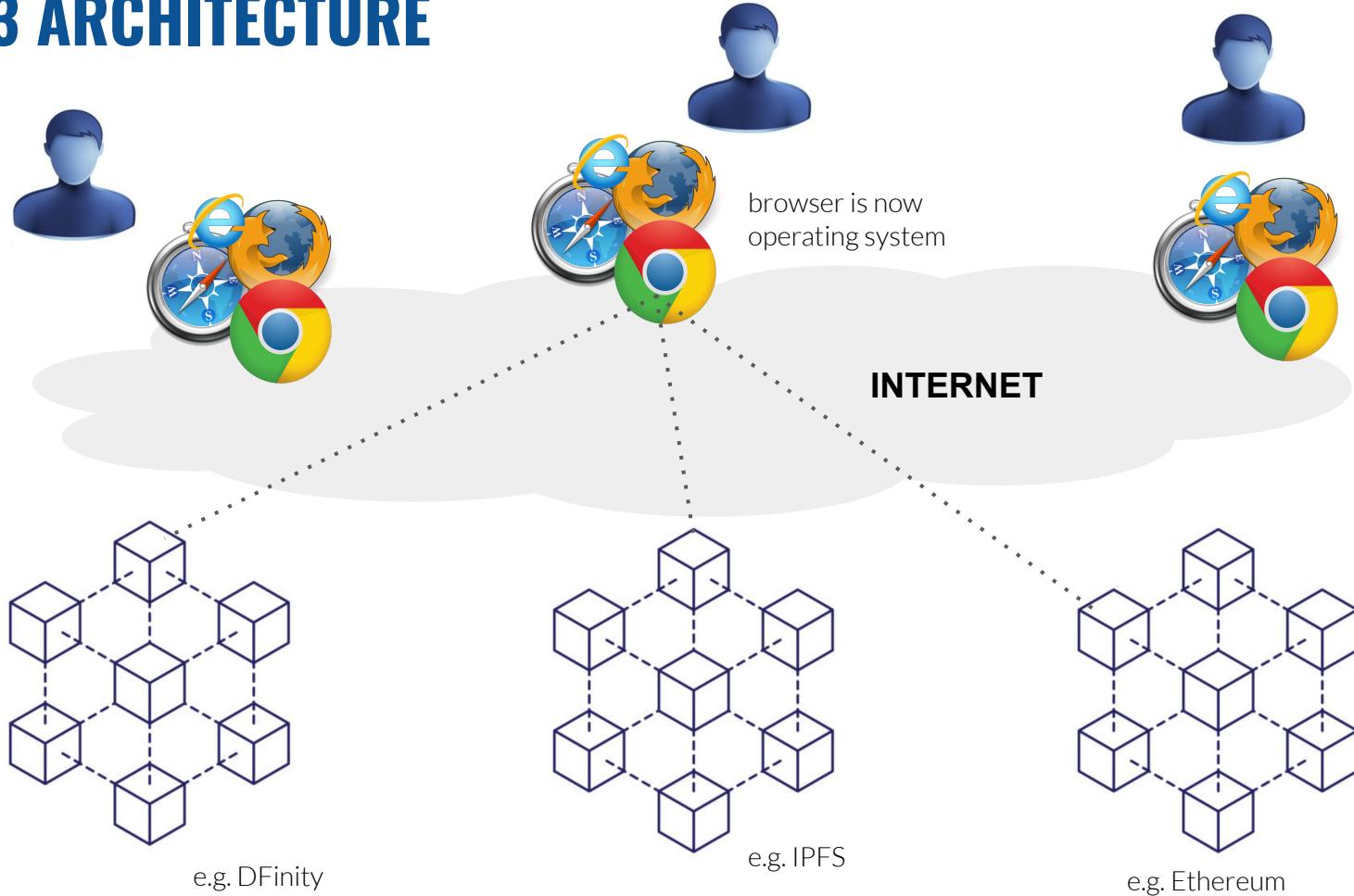
# INTERNET TODAY = 99% CLIENT SERVER



# WEB 3 = BLOCKCHAIN = STILL CLIENT SERVER



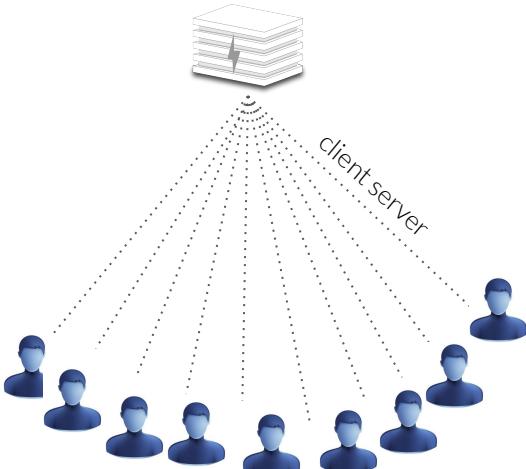
# WEB3 ARCHITECTURE



# PATH TO WEB 4.0

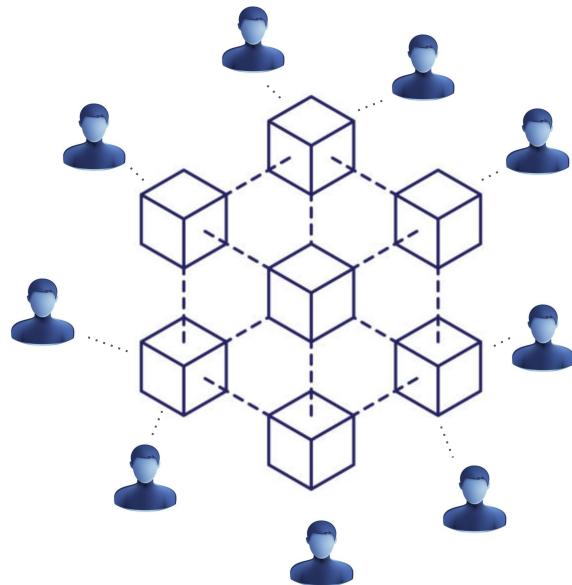
## WEB 1.0 & 2.0 CLIENT SERVER

### APPLICATION



## WEB 3.0 BLOCKCHAIN

### APPLICATION



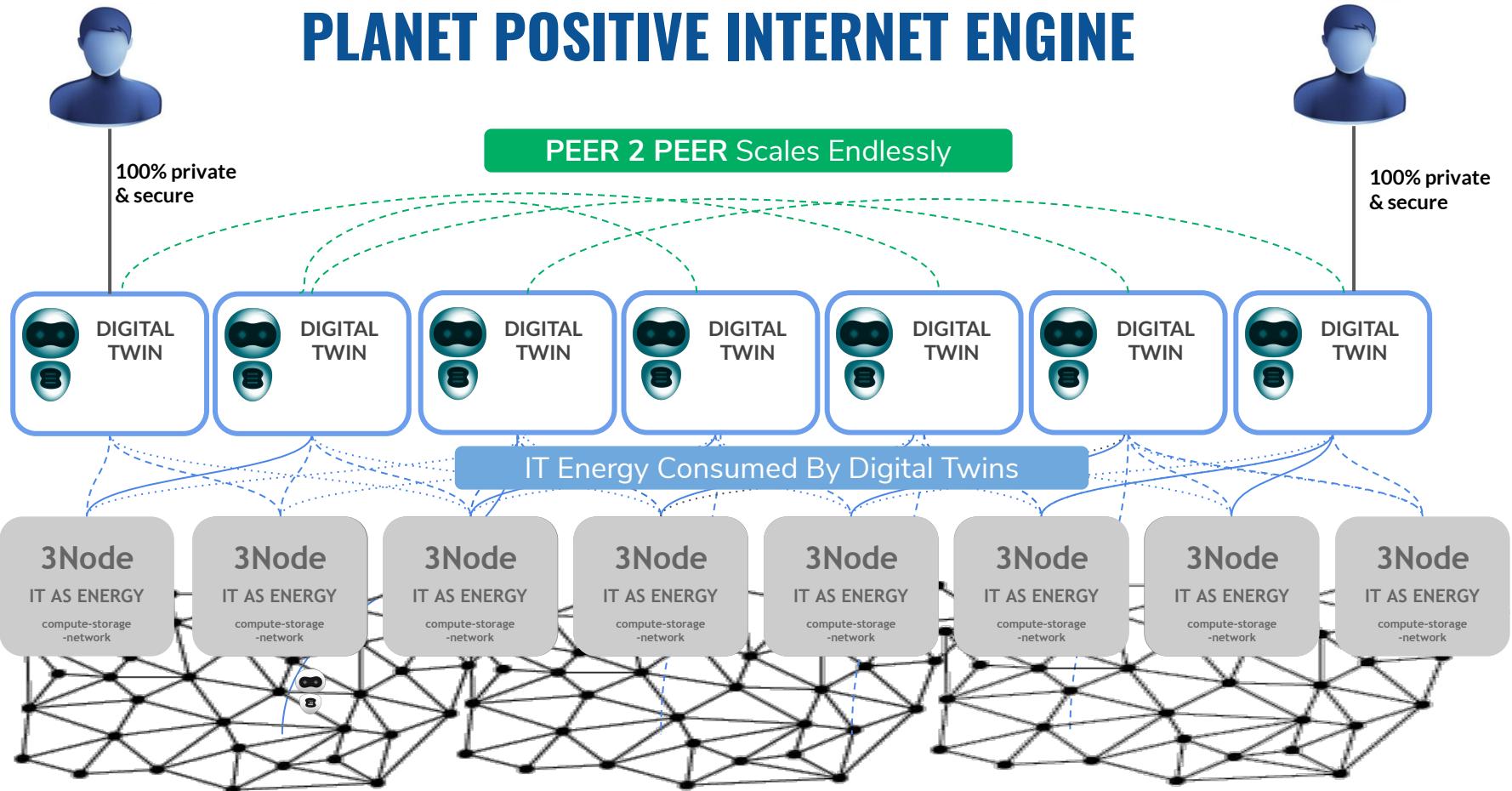
# THREEFOLD

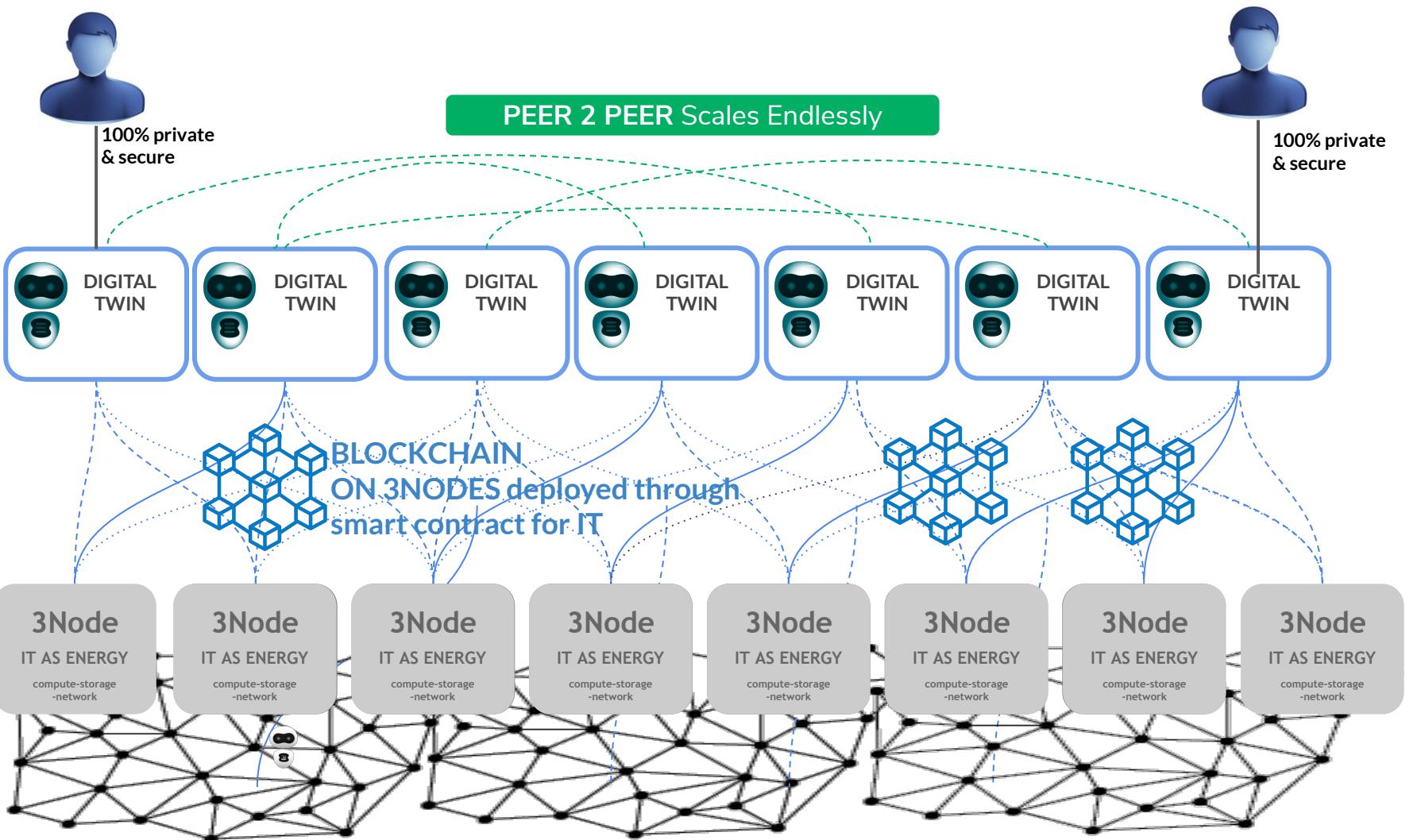
## WEB 4.0 PEER2PEER

Neutral & Safe  
Efficient & Green  
Fair & Reliable

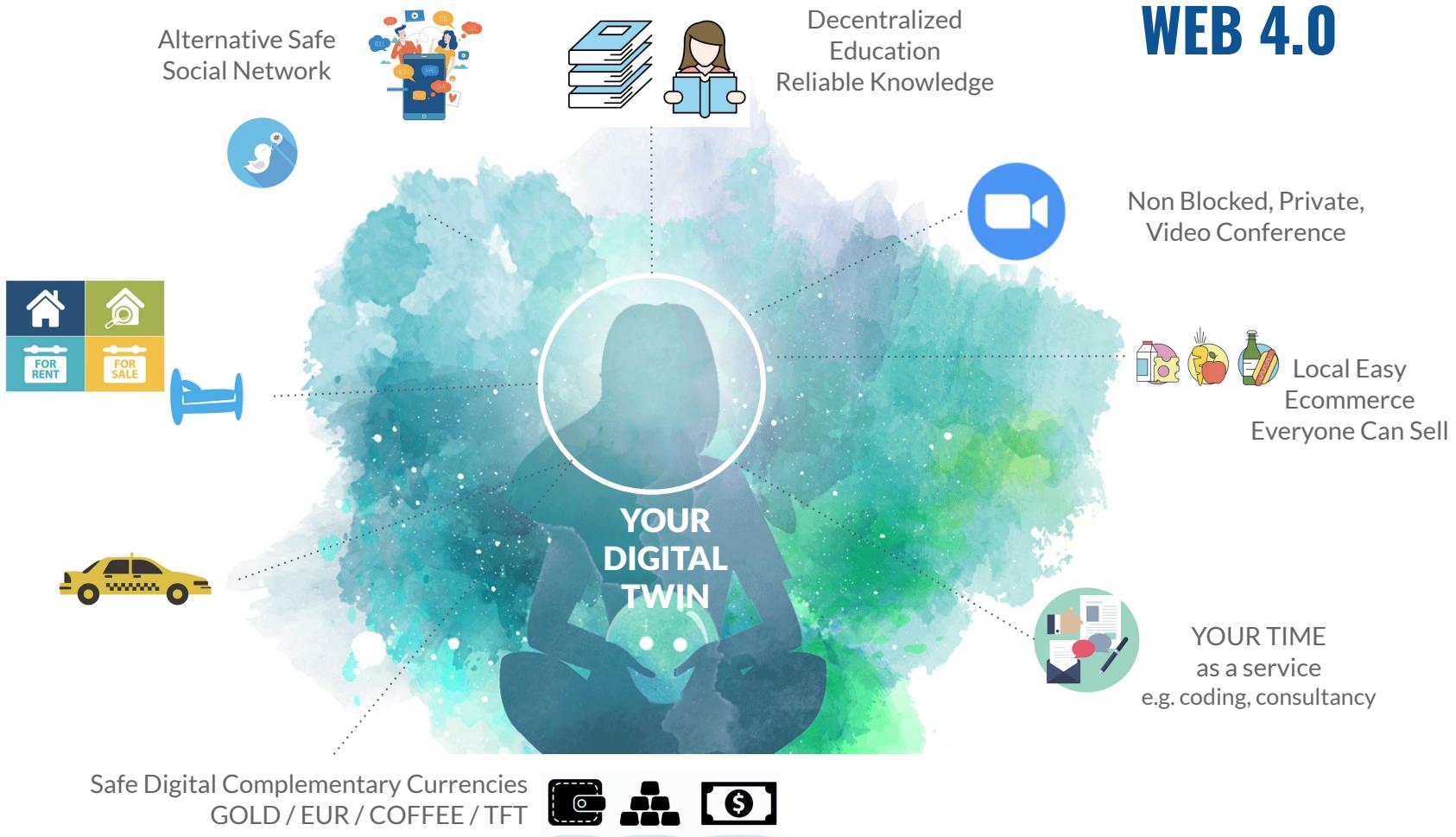


# PLANET POSITIVE INTERNET ENGINE





# WEB 4.0



# YOU IN THE CENTER OF YOUR DIGITAL LIFE



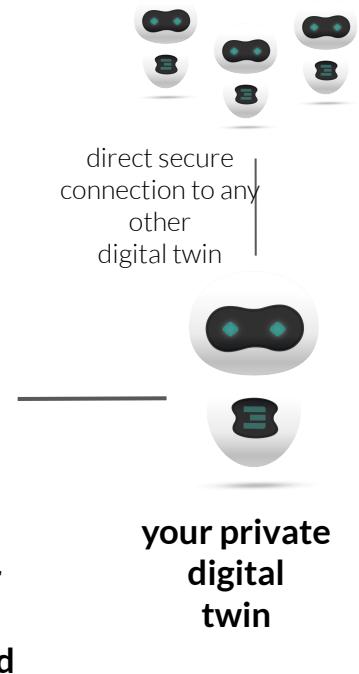
only  
input  
output  
done  
here



any  
browser

secure  
browser  
engine  
on TFGrid

Visualization &  
Javascript  
runs here  
In secure  
environment

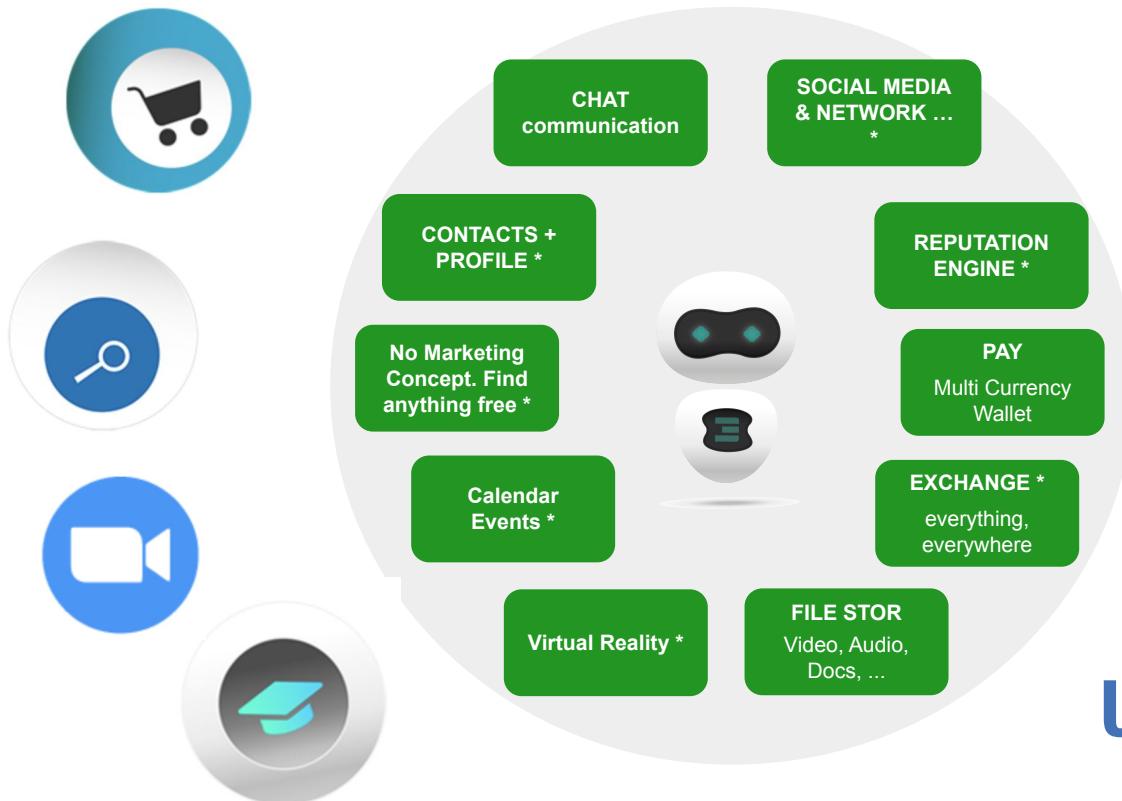


all digital life  
logic & storage  
only lives in  
private  
digital twin

your private  
digital  
twin

direct secure  
connection to any  
other  
digital twin

# YOUR DIGITAL TWIN CAPABILITIES GROW ...



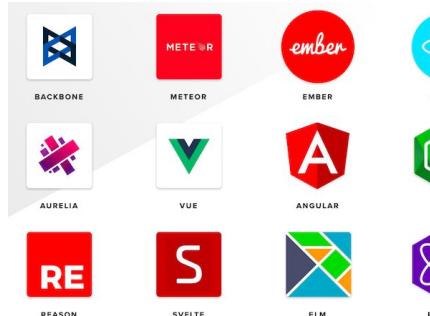
**MILLION OF  
EXPERIENCES  
USE THE CAPABILITIES**



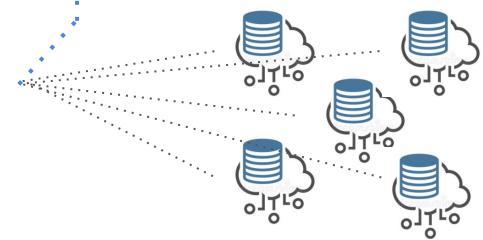
EXPERIENCES  
NOT APPS

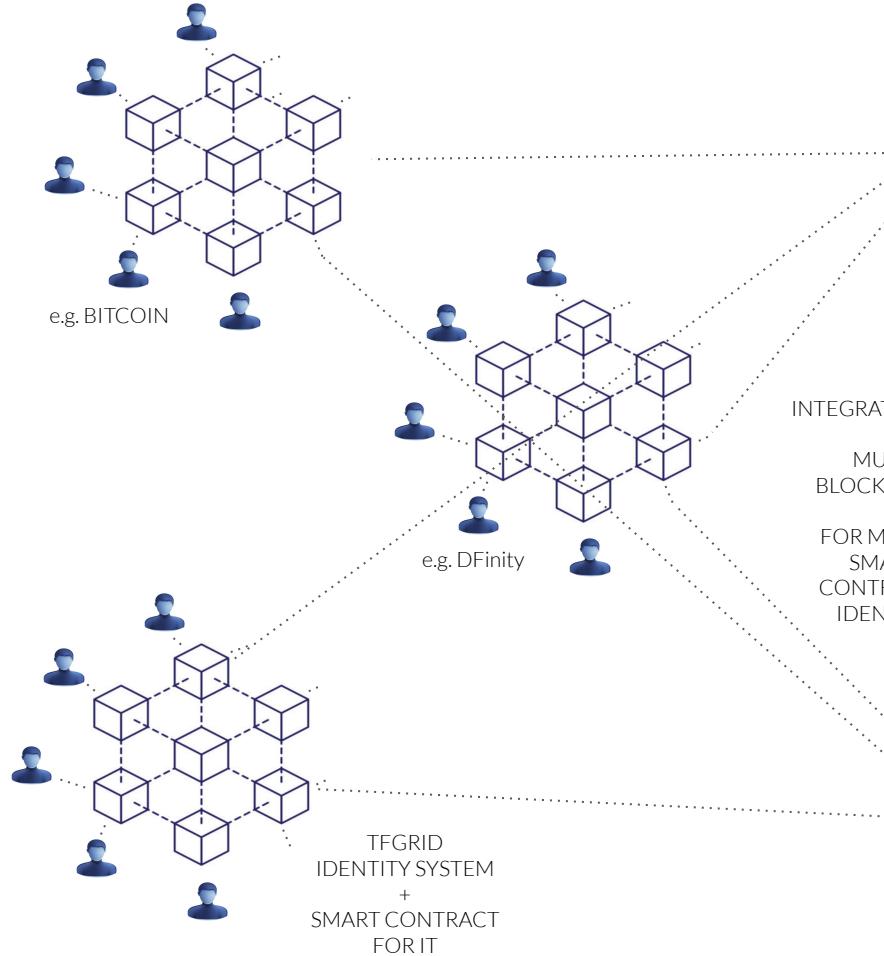
your full digital life  
100% owned by  
you

ANY EXISTING  
WEB  
FRAMEWORK  
CAN BE USED  
TO CREATE THE  
EXPERIENCES

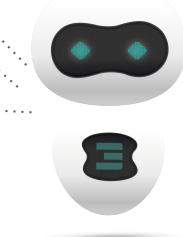


SHORTEST PATH  
PEER2PEER  
COMMUNICATION  
NO SSL KEY  
EXCHANGE

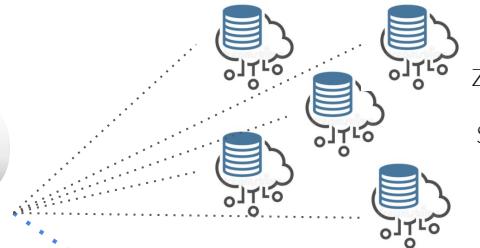




INTEGRATES WITH  
MULTI  
BLOCKCHAIN  
FOR MONEY,  
SMART  
CONTRACTS,  
IDENTITY



SHORTEST PATH  
PEER2PEER  
COMMUNICATION  
NO SSL KEY  
EXCHANGE



Zero-knowledge  
Quantum Safe  
Storage System  
100% private  
Per Twin  
Distributed over  
10+ 3Nodes

### 3NODES

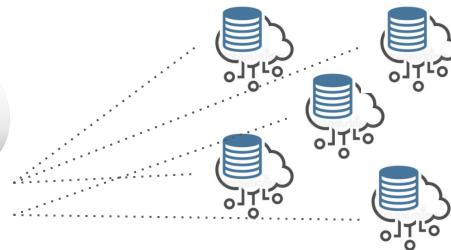
DELIVER THE COMPUTE & NETWORK CAPACITY REQUIRED



VIDEO CONFERENCE CAPACITY

GAMING ENGINES

ADDITIONAL COMPUTE CAPACITY



Zero-knowledge Quantum Safe Storage System

100% private Per Twin

Distributed over 10+ 3Nodes



SMTP  
IMAP  
WEBDAV  
CALDAV  
IPFS  
S3  
FTP  
HTTP(S)

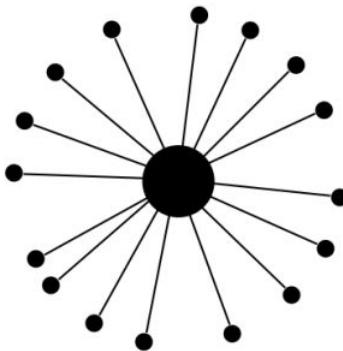


WEBGW

SPEAKS INTERNET PROTOCOLS

INTERNET 1.0 ... 3.0

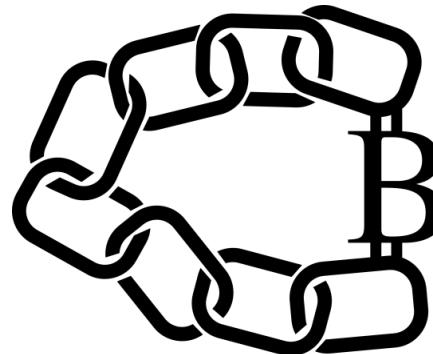
# CENTRALIZED AS WE KNOW "IT"



## Centralised Data:

- Star/Pyramid systems =
- People driven.
- Way too complex.
- Centralized Data
- Often Power Hungry
- Can Be Slow & Unscalable
- Expensive

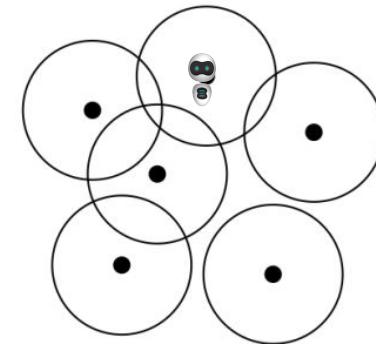
# DISTRIBUTED/SHARED BLOCKCHAIN



## Shared Data:

- Perfect for money & smart contracts
- Has limits in relation to usage for digital twin and cloud usecase.
- Often not decentralized, sovereign & private.

# PEER2PEER THREEFOLD



## Living Grid Of Intelligent Cells Usable for Secure Cloud & Digital Twin

- Super secure & private
- Green (upto 10x power savings)
- Unlimited Scalable / Fast
- Self Healing & Cost Effective
- Sovereign & Decentralized

INTERNET 1.0/2.0

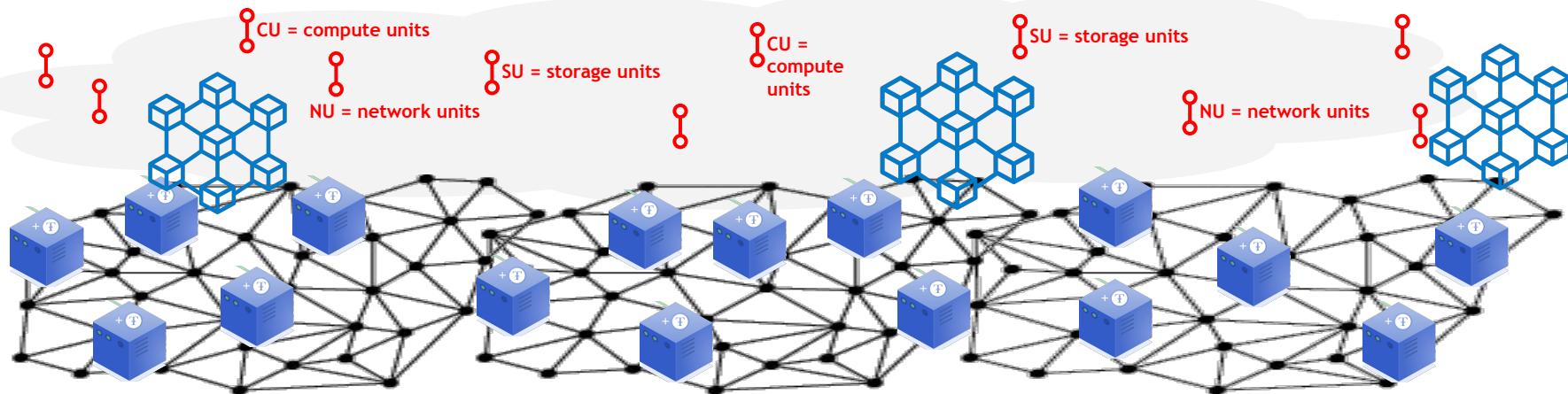
BLOCKCHAIN + INTERNET 3.0

INTERNET 4.0

ANY WEBSITE OR JAVASCRIPT APP  
CAN INTERFACE  
WITH THE Digital Twin



ANY APP WHICH RUNS ON LINUX  
CAN RUN ON THE THREEFOLD GRID



THREEFOLD

IT AS ELECTRICITY LAYER

# A PLANET POSITIVE INTERNET ENGINE

*Result of +20 years of development*

## THE 3NODE OS = Zero-OS

OPEN SOURCE CLOUD OPERATING SYSTEM WHICH IS LOCAL, MORE EFFICIENT, SUSTAINABLE & SECURE.



3Nodes are set-up across geographical borders to form a global peer-to-peer network -- The ThreeFold Grid

Zero-OS is our stateless and lightweight open-source operating system that makes 3Nodes trustful, secure and energy efficient.

Anyone can add capacity to the ThreeFold Grid.

## YOUR DIGITAL TWIN

BE IN CONTROL OF YOUR DIGITAL LIFE. FROM SOCIAL DILEMMA TO SOCIAL FREEDOM.



For your DATA and any Digital Life EXPERIENCE.

Your digital avatar -- all you need in 1 place. From APP centric to Human Centric.

Giving room for a global ecosystem to create experiences, but you remain the orchestrator of your digital life.

25 Digital Twins consume the same amount of energy as a light bulb.

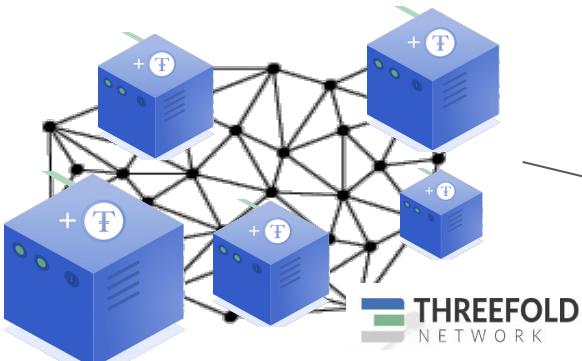
## DOUBLE CARBON WIN:

THE THREEFOLD INTERNET DOES NOT ADD CO<sub>2</sub>, BUT REMOVES 2X MORE THAN IT ADDS.

# INSPIRED BY NATURE

3NODES ARE LIKE OUR BODY, THEY ARE THE HOST  
= ENERGY, SPACE

EACH 3NODE IS A COMPUTER DELIVERING  
storage, compute & network capacity.

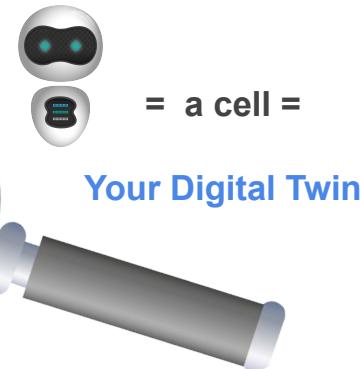


THE 3NODES DELIVER THE REQUIRED  
SPACE & ENERGY FOR THE DIGITAL TWINS TO FUNCTION.

DIGITAL TWINS ARE LIKE CELLS IN OUR BODY

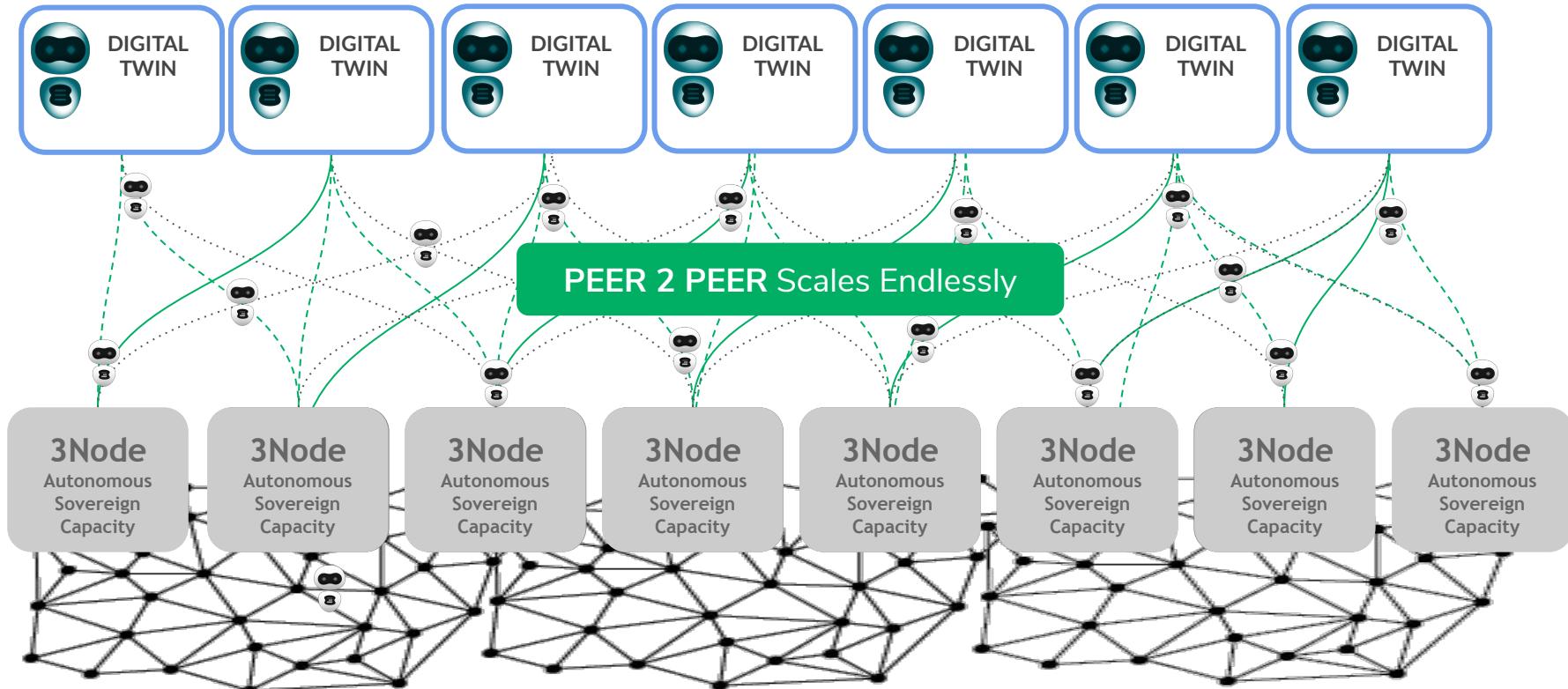
Each TWIN represents a person or legal entity.

The TWIN owns the information and knowledge required to let the global digital universe function, they are like the cells in our body.



THE AUTONOMOUS DIGITAL TWINS  
ARE THE BASIS FOR AN UPGRADED  
SUPER SECURE AND SUSTAINABLE DIGITAL ECOSYSTEM.

# ENDLESS SCALABILITY, SECURE, GREEN & ULTRA RELIABLE



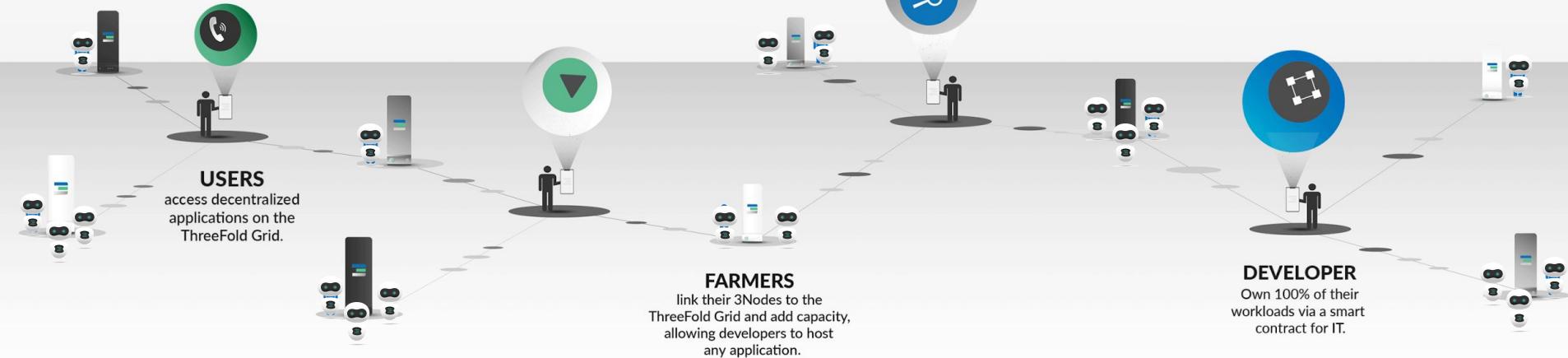
# BE THE INTERNET

## PLANET POSITIVE INTERNET ENGINE EMPOWERED THREEFOLD GRID

**Sovereign** your own data private in your own country.  
**Equal** everyone equal rights to education, information, ...  
**Sustainable** double carbon neutral + energy savings

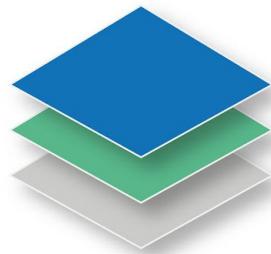
*EXTEND THE NETWORK = BECOME A FARMER  
DEPLOY YOUR APPS  
TAKE CONTROL OVER YOUR DIGITAL LIFE*

+14,000 CPU Cores  
+80.000.000 GB of storage live  
May 2021

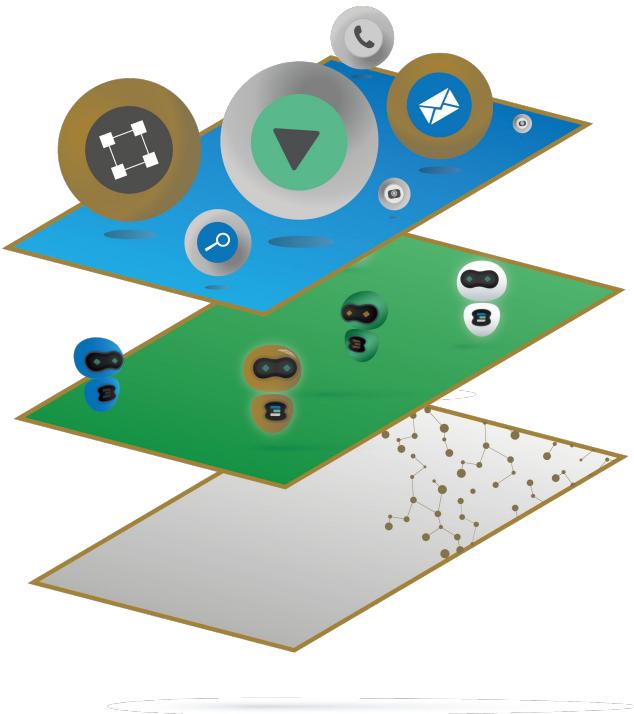


**WE ONLY NEED THREE LAYERS  
TO MAKE OUR DIGITAL WORLD  
SAFE, GREEN & RELIABLE**

Our open source technology promotes transparency.



# THREEFOLD TECHNICAL ECOSYSTEM



## EXPERIENCE LAYER

All kinds of applications (experiences) can be built on the **DIGITAL TWIN**. 90% less time to develop, more security, sustainability, fairness and equal access for everyone. Imagination sets the boundary to the possibilities of the experience layer. We invite everyone to build applications (2021).

## PLANET CAPABLE: AUTONOMOUS LAYER

This layer is the home of everyone's "digital avatar": The **DIGITAL TWIN**. It hosts all your personal data and ensures that only you can grant and revoke access to this information. The decentralized peer2peer architecture paired with Self-Driving/Healing IT allows for superior reliability and security.

## QUANTUM SAFE: CAPACITY LAYER

Potentially the safest compute, network & storage system on the planet. Our own **ZERO OS** operating system eliminates multiple layers of complexity and is highly resilient. Its lightweight architecture makes it scalable and 10 times more efficient for blockchain & storage.



LAYER ONE

## EXPERIENCE LAYER

Any web technology can be used to create the most amazing applications. The applications are 100% decentralized and take 10x less time to develop. Any existing web based app can be converted in no time.

We are there to help anyone who wants to create experiences (apps) on top of our quantum safe cloud.

Existing tools and frameworks can be used.





## LAYER TWO

### THE AUTONOMOUS LAYER

3BOTs

virtual system admin

DIGITAL TWINS

your digital avatar

Self-driving and self-healing technology allows for 100% decentralization. Includes super efficient blockchain database and object storage technology. More than 50x efficiency savings for blockchain-related workloads, and 10x for storage.

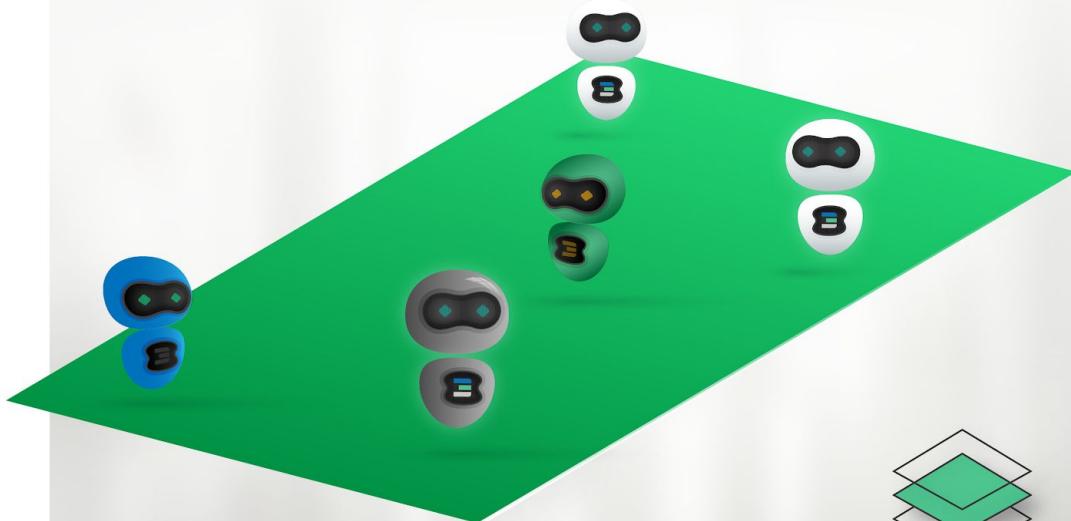
And each user or legal entity has its own digital twin.

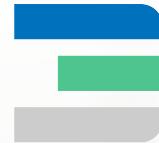
PLANETARY SECURE NETWORK

PLANETARY SECURE FILESYSTEM

DIGITAL TWIN

3BOT





### LAYER THREE

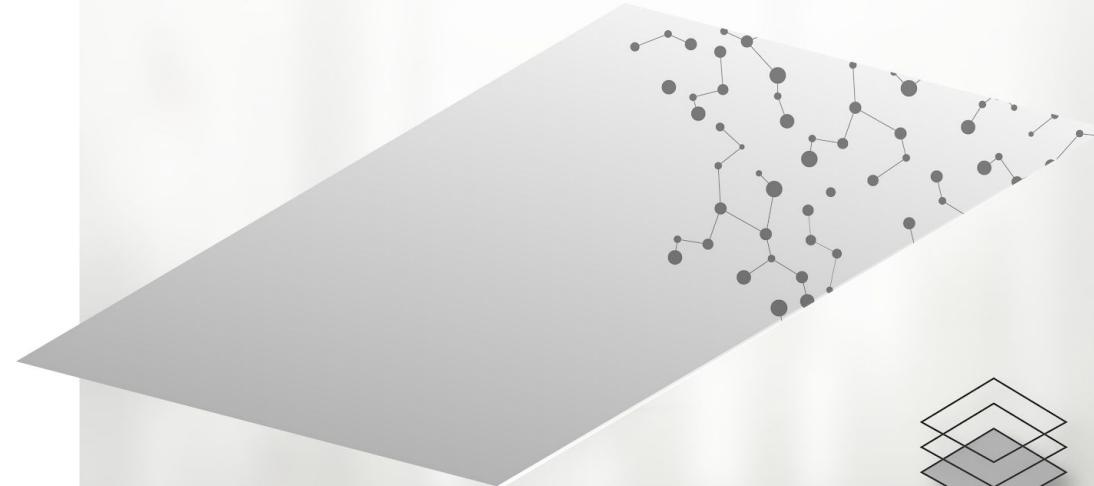
## THE CAPACITY LAYER

Low level technology. Delivers the required capacity for your IT solution. Any applications which can run on Linux can run on the TF Grid and our systems provide more decentralization, security, and efficiency.

Can be a more sustainable host for any existing blockchain enabled or web project.

PEER2PEER COMPUTE  
PEER2PEER NETWORK

QUANTUM SAFE STORAGE



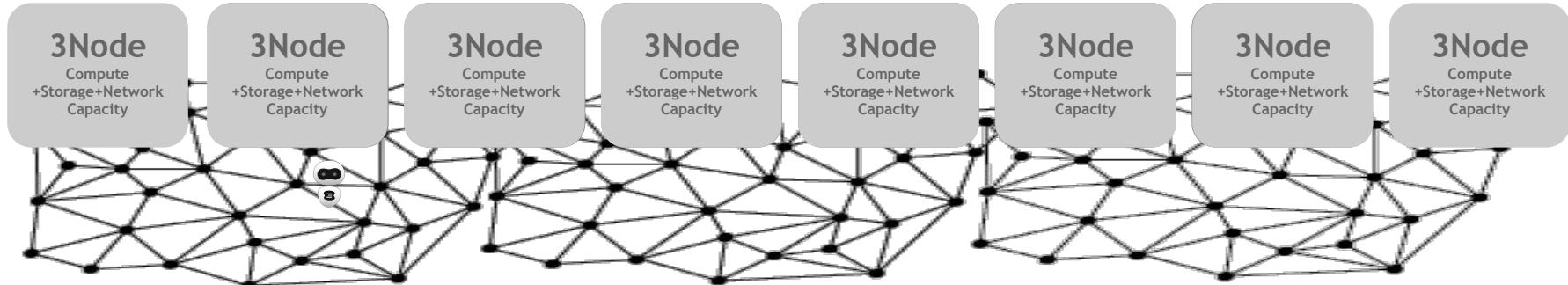
# DEVELOP for DIGITAL TWIN vs YOUR APPS ON CAPACITY LAYER

A peer2peer autonomous cloud system to upgrade our digital life.

ANY JAVASCRIPT APP CAN INTERFACE  
WITH THE Digital Twin  
USING OUR PROTOCOL.ME INTERFACE.



ANY APP WHICH RUNS  
ON LINUX CAN RUN ON  
THE 3NODES (ZERO-OS)



# THE MAGIC

DISRUPTIVE NETWORK, COMPUTE & STORAGE TECHNOLOGY



## QUANTUM SAFE STORAGE

+10x more efficient

Store Zetta Bytes of data  
so safe that even a quantum  
computer can not break it

## Unbreakable Storage

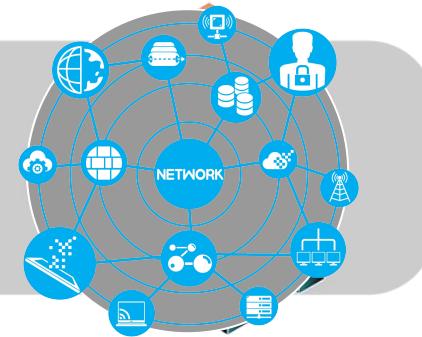


## PEER2PEER COMPUTE

Unique Internally Developed  
Operating System

## Zero Attack Surface

**Most Secure & Efficient**  
Utilization of Server Hardware



## PEER2PEER NETWORK

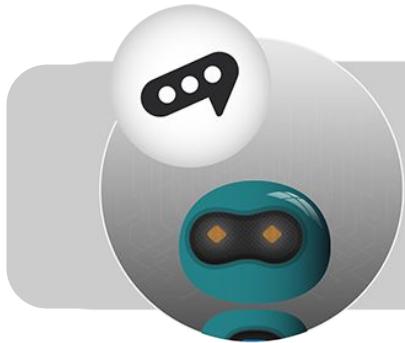
P2P end2end encrypted overlay  
Network with integrated name  
services on blockchain

Planet Global IP  
Strongly Authenticated



# THE MAGIC

## SOVEREIGNITY SOLUTION



### DIGITAL TWIN TECHNOLOGY

Digital Avatar Server Software.  
Your Digital freedom and  
sovereignty at scale

**less than 1 USD per month.**  
for your full Digital Life Enabled

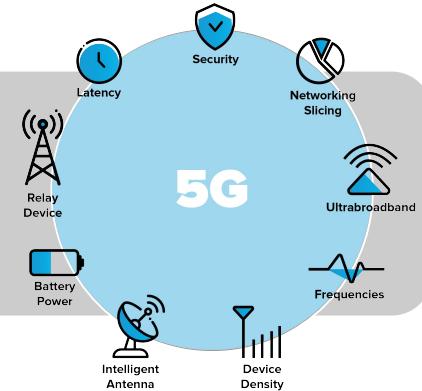


### SECURE REMOTE BROWSER ENGINE

No more javascript running in  
your browser in desktop or  
mobile.

Integrated security recording  
possibility

2 codecs available.



### 5G PERFORMANCE (\*)

on

### 4G FREQUENCIES

No health danger.  
2x more reach compared  
to current 4G

**No backdoors !!!!**

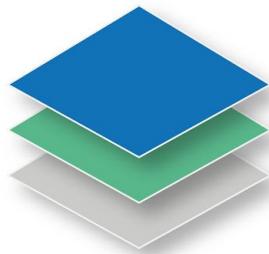
More efficient & Sustainable.

(\*) together with partner

## USE CASES

## WHY US?

Our open source technology promotes traction & gives confidence.



# USERS OF OUR PEER2PEER CLOUD & INTERNET SYSTEM

## DEVOPS & SYSTEM INTEGRATOR

eVDC = Virtual  
DataCenter

open to standards:  
Docker, Kubernetes,  
S3 storage server ...



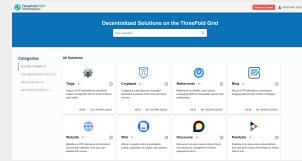
## IT SYSTEM DEVELOPERS

Virtual System  
Administrator  
  
FOR EXPERTS WITH  
NO LIMITS (-:



## COMMUNITY BUILDERS

**THREEFOLD.NOW**  
Ready made solutions that are  
available for communities seeking  
alternatives to centralized services

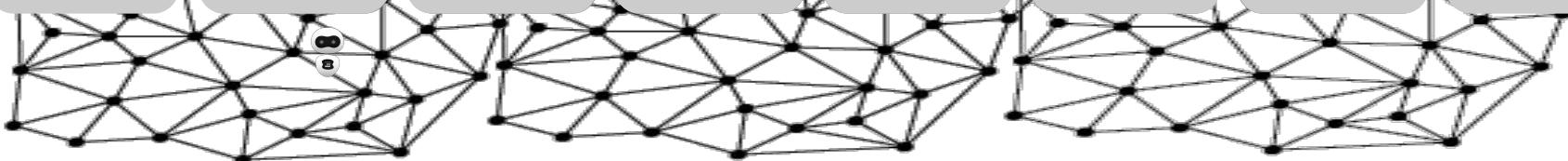


## DAPP DEVELOPERS (Q1 2021)

any javascript app can interface  
through the  
**PROTOCOL.ME INTERFACE.**



**3Node**  
Autonomous  
Sovereign  
Capacity



## Phase 1: 2019+

### Classic IT Workloads

Compute = containers  
Storage & networking (testnet)



## Phase 2: H2 2020+

### Blockchain As A Service

More Secure  
Scalable & Green



### Internet of Things or 5G workloads



### High Security IT Workloads

e.g. Banking

Give Hackers No Chance



### Beyond Blockchain

#### DB/ARCHIVE

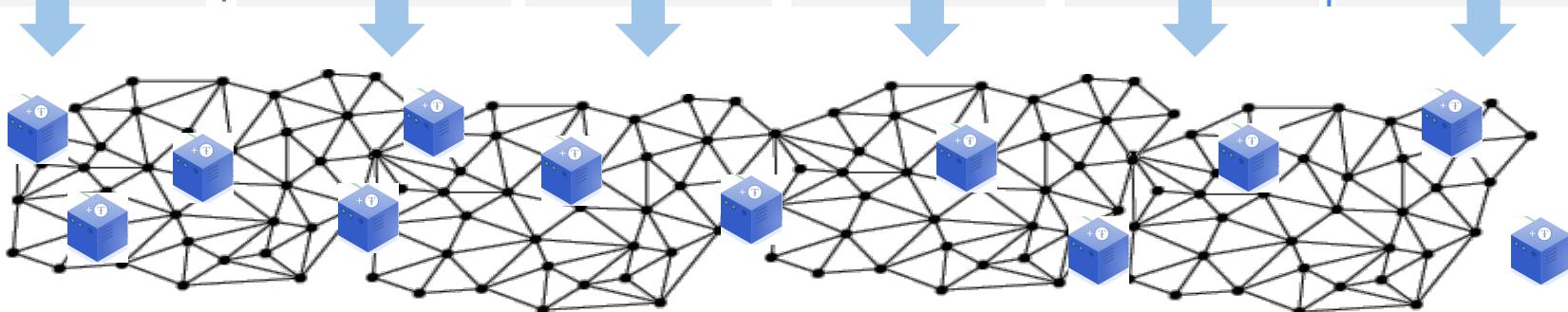
e.g. Secure Archive

Most efficient, cost effective  
large scale archive solution  
which operates like a  
blockchain without the  
downsides.

## Phase 3: H2 2021+

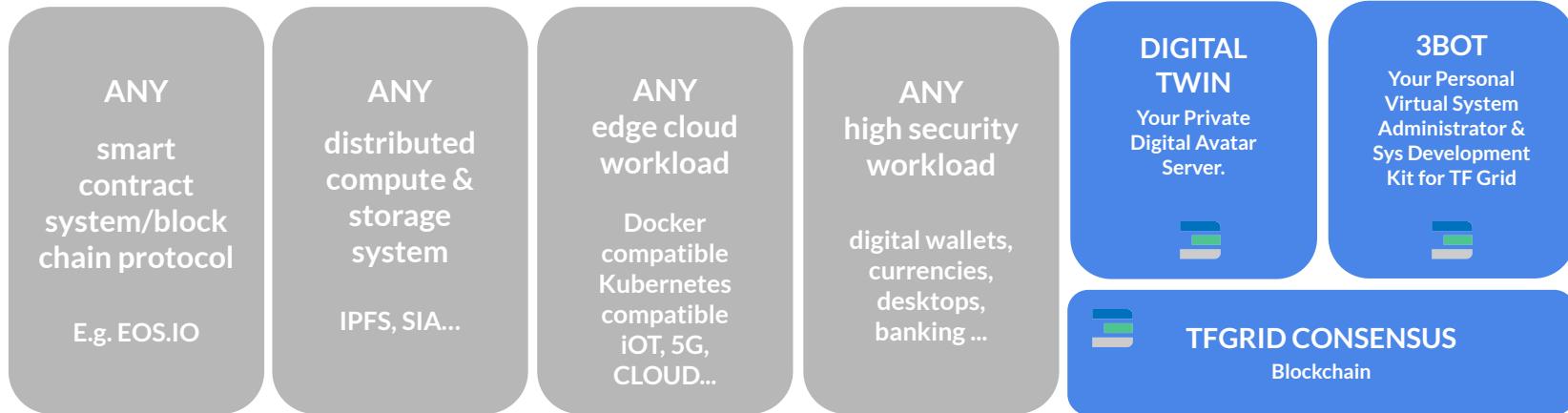
Dapp Development Layer  
for  
your decentralized  
digital apps

any web app ...



# THREEFOLD GRID ARCHITECTURE

UNIVERSAL LAYER FOR A MORE SUSTAINABLE DIGITAL LIFE.



**ThreeFold Grid (enterprise, government & public)**  
independent ThreeFold farmers and partners are building the biggest  
global grid of Network, Storage & Compute resource in the world



**ThreeFold Zero OS** = more performance, sustainable & security  
Storage, Compute & Network Layer + Smart Contract For IT

# BENEFITS

Our software technology stack enables truly decentralized peer-to-peer network, compute and storage capacity.



## SOVEREIGN

local to you,  
in line with  
regulations.

## PRIVATE

only you own your  
data and your  
digital experiences.

## AUTONOMOUS

self-driving and  
self-healing.

## DECENTRALIZED

the system is owned  
by all of us and  
available  
everywhere for all.

## COST EFFICIENT

2 to 10x more cost  
efficient. Equal  
chances for all.

## SUSTAINABLE

planet, eco friendly  
and energy efficient.  
Upto 10x savings.

## ENDLESSLY SCALABLE

Linear scalable.  
No Bottlenecks.  
Peer2Peer

## SECURE

many unique features  
provide for potentially  
the most secure  
platform in the world.

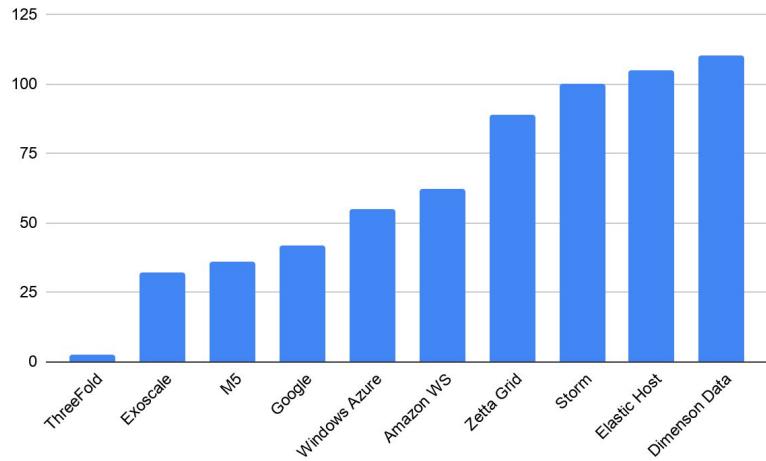
## THREEFOLD PEER2PEER CLOUD and DIGITAL TWIN

**A 100% re-invented technology stack delivers true change.**

	THREEFOLD GRID + DIGITAL TWIN	BLOCKCHAIN Storage or Compute	TRADITIONAL Centralized Cloud
Company	ThreeFold Technology	Sia, FileCoin, Golem, Dfinity, ...	Amazon, Alibaba, Google
Number of Transactions per Second	Unlimited because of scale out	Limited to design of blockchain.	Unlimited
Response Times	< 100 ms because more local	Typically Slow	< 200 Milliseconds
Decentralized / Neutral	YES	SOMETIMES	-
Blockchain Secure	YES	YES	-
Zero People and 100% Self-Healing	YES	SOMETIMES	-
Tokenized by Digital Currency	YES	YES	-
Privacy	YES	encryption based, but privacy leaks	-
Featureset	Good Enough	Limited	Overwhelming but complex
Cost Efficiency	Better than Cloud	Better than Cloud	Expensive
Empowers Peer2Peer Web	YES	YES	-
Energy Efficient & Green	YES (upto 100x better)	-	-
Actual Capacity Deployed	18k CPU cores 90.000.000 GB of storage	Growing	Large but Mostly Centralized

# DISRUPTIVE TECHNOLOGY PROVIDES BETTER COST BASE

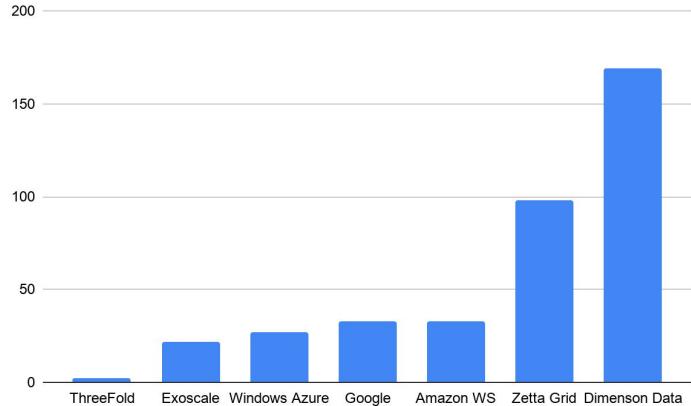
## COMPUTE



Pricing is calculated for the following configuration:  
RAM: 4GB Storage: 200GB CPU equals Xeon E5520: 1X

**Our Cost = USD 2.5 vs end user price USD 32-110**

## STORAGE



Pricing is calculated for the following configuration:  
Storage: 1,000GB , Transfer: 100 GB

**Our Cost = USD 1-2 vs end user price USD 22-160**



comparison tool used see  
<https://www.cloudorado.com/>  
price per month in USD

# WE ARE THE ANTIDOTE TO THE CYBER PANDEMIC

Our open source technology promotes security.



# MAGIC 1: ISOLATE THE VIRUS or BACKDOOR



The Cyber Virus  
gets No Chance.

No Communication  
Possible with HQ or  
other Cyber Viruses

It's a complete block  
per virus/backdoor.

# MAGIC 2: DATA IS STORED QUANTUM SAFE



DATA STORED  
IN SUCH A WAY THAT  
DATA CANNOT BE LOST  
= unbreakable  
EVERYONE OWNS  
THEIR DATA  
= private  
EVEN A QUANTUM  
COMPUTER CANNOT  
DECIPHER & HACK  
= safe

# MAGIC 3: SELF HEALING AUTONOMOUS OPERATIONS



We need a self driving  
ICT System.

Improve the command &  
control concept.

**IT world upside down.**

Entangled Cellular  
Compute & Network  
Technology.

**State**  
Storage (Done since 2018)  
Compute (2021)

# PEER2PEER CLOUD (CAPACITY LAYER)

- **Quantum Safe Storage System**

- even quantum computers cannot hack and "decrypt" data
- data can never be lost, unlimited history, auditing on digital ledger layer
- 10x less power utilization (green)
- data distributed in controlled way over X nr of chosen locations, but none of the locations has enough data to reconstruct the original = super reliable/safe

- **Peer2Peer Network and Compute System**

- as delivered by our Zero-OS = our own custom operating system.
- most efficient & safe utilization of hardware resources
- network wall: no tcp-ip travels from internet to compute (apps),
- isolate processes 100% from the internet
- smart contract for IT layer, super controlled way how to deploy apps
- ZeroOS filesystem (ZOS-FS):  
only boot signed/fingerprinted files, not possible for hacker to change any content & insert backdoors
- Peer2peer network: end2end encrypted network layer between compute layer and users.
- Optional: FPGA based network switch & NIC (work in progress):  
hundreds of gbits of bandwidth, no need for TCPIP in the fabric, super low latency, 0 backdoors

# PEER2PEER CLOUD (USER LAYER)

- **Quantum Safe Filesystem**

- generic usable filesystem writes to the secure storage backend on planetary scale.
- allow anyone to run their storage apps (using existing interfaces & standards) everywhere in the world and securely connect and use the quantum safe storage system as backend.

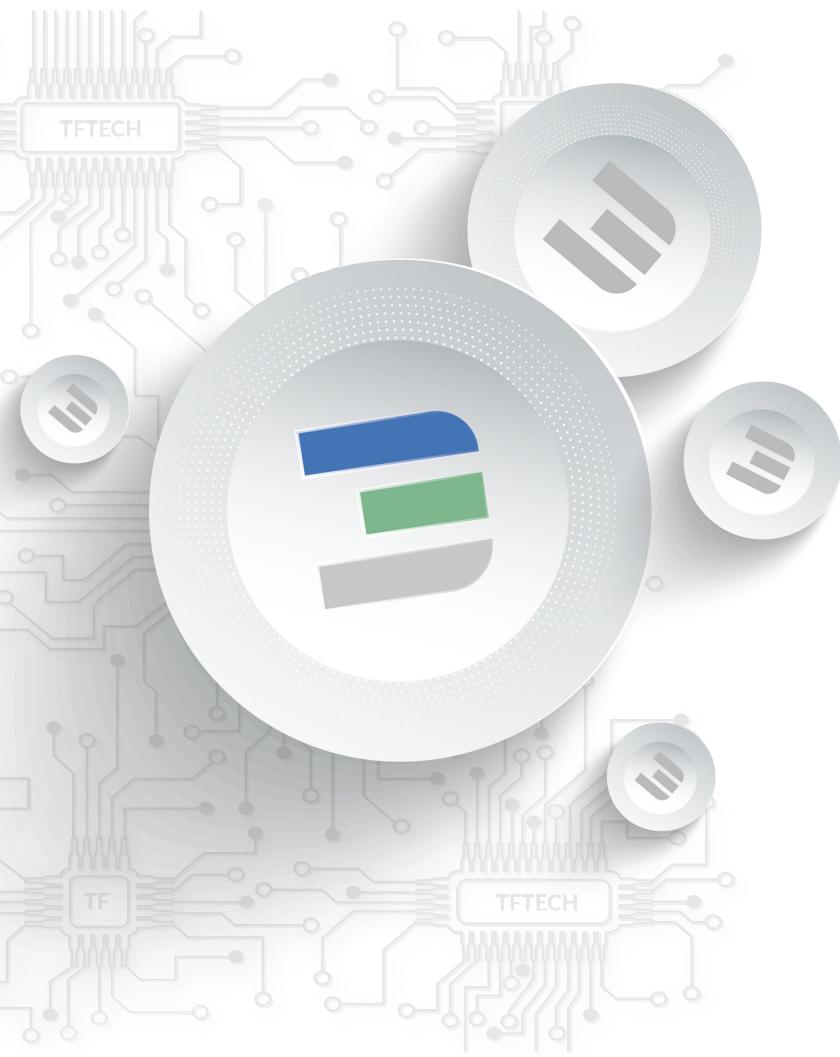
- **Planetary Network**

- Public side of our planetary secure network.
- connect everyone in the world (mobile & desktop), end2end encrypted
- strongly authenticated at the edge.
- no more need for centralized firewalls, every node in the planetary network arranges its own encryption, routing and authentication
- integrated name services (like DNS)

- **Web 2.0 Interface Layer**

**= emulation layer which exposes services using standards for existing internet**

- secure browser engine = no need to run javascript on your mobile or desktop
  - only the output of your secure browser engine process is shown in your desktop or mobile os, no more need for browser in your desktop/mobile device.
- web gateway = mimic web and other internet interfaces and
  - transport data itself in secure way over network wall



# PEER2PEER Compute System

## Zero-OS

AS EASY AS USING ELECTRICITY  
FROM THE ELECTRICITY GRID

**'PLUG AND PLAY'**

Connect it to power supply  
and internet



**POWER  
OUTLET**



**NETWORK, COMPUTE & STORAGE SERVER**  
Enabled by Zero-OS

**GENERATE**

COMPUTE+STORAGE+NETWORK CAPACITY  
**More reliable, cost effective & green.**



**INTERNET  
CONNECTION**

# ZERO-OS: A LIGHTWEIGHT STATELESS SECURE OPERATING SYSTEM

## Core-0

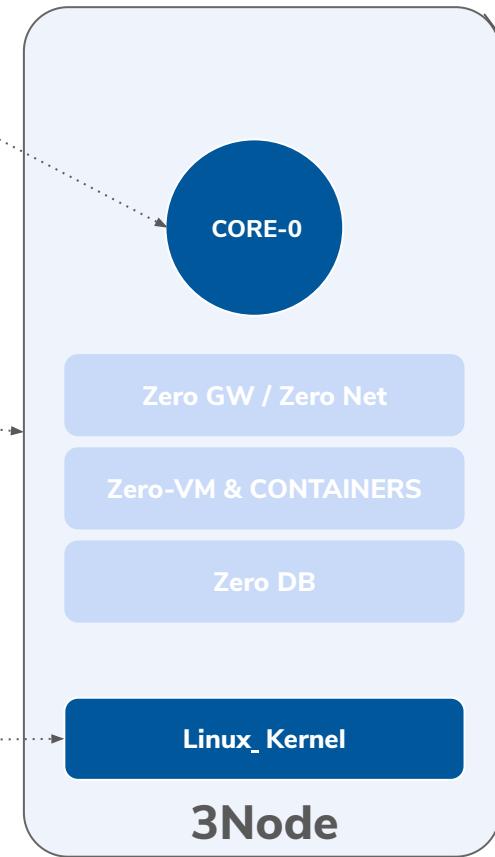
First process launched on the Zero-OS. This process kicks off all activities on the node and allows the full OS to be booted over the network maintaining full integrity and hacking surfaces.

## Hardware Node

All nodes are based on Intel, AMD or ARM\* based CPU's. The peripheral hardware requires an amount of CPU cores, GB's of memory and physical storage devices, ideally a mix of SSD and .HDD.storage.....

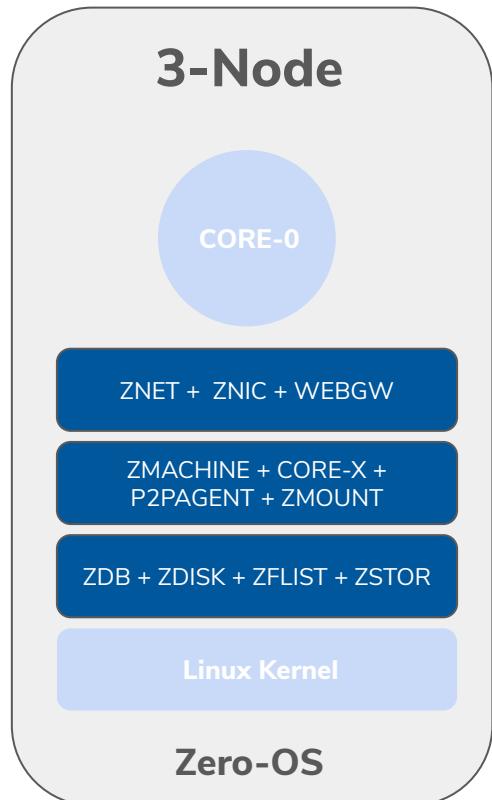
## Kernel

Zero-OS uses the well known Linux kernel because it has device drivers for almost any hardware that exists (Intel / AMD processor types. TFTech customized the kernel: make it smaller and added secure boot elements.



\* on request

# ZERO-OS : BASE FUNCTIONS NETWORK



## 3-Node

CORE-0

ZNET + ZNIC + WEBGW

ZMACHINE + CORE-X +  
P2PAGENT + ZMOUNT

ZDB + ZDISK + ZFLIST + ZSTOR

Linux Kernel

Zero-OS

### ZNET

Encrypted/Private P2P Network  
between ZMachines

### ZNIC

ZNIC is the interface of our planetary  
network. Is a P2P network on top of  
internet. Looks for shortest path.

### WEBGW

Bridge existing internet protocols to  
ZMachines using P2PAgent

Examples SMTP(\*), IMAP(\*), HTTP,  
FTP(\*), DNS, IPFS(\*), S3(\*) ...

Fallback to TCP if protocol not  
implemented.

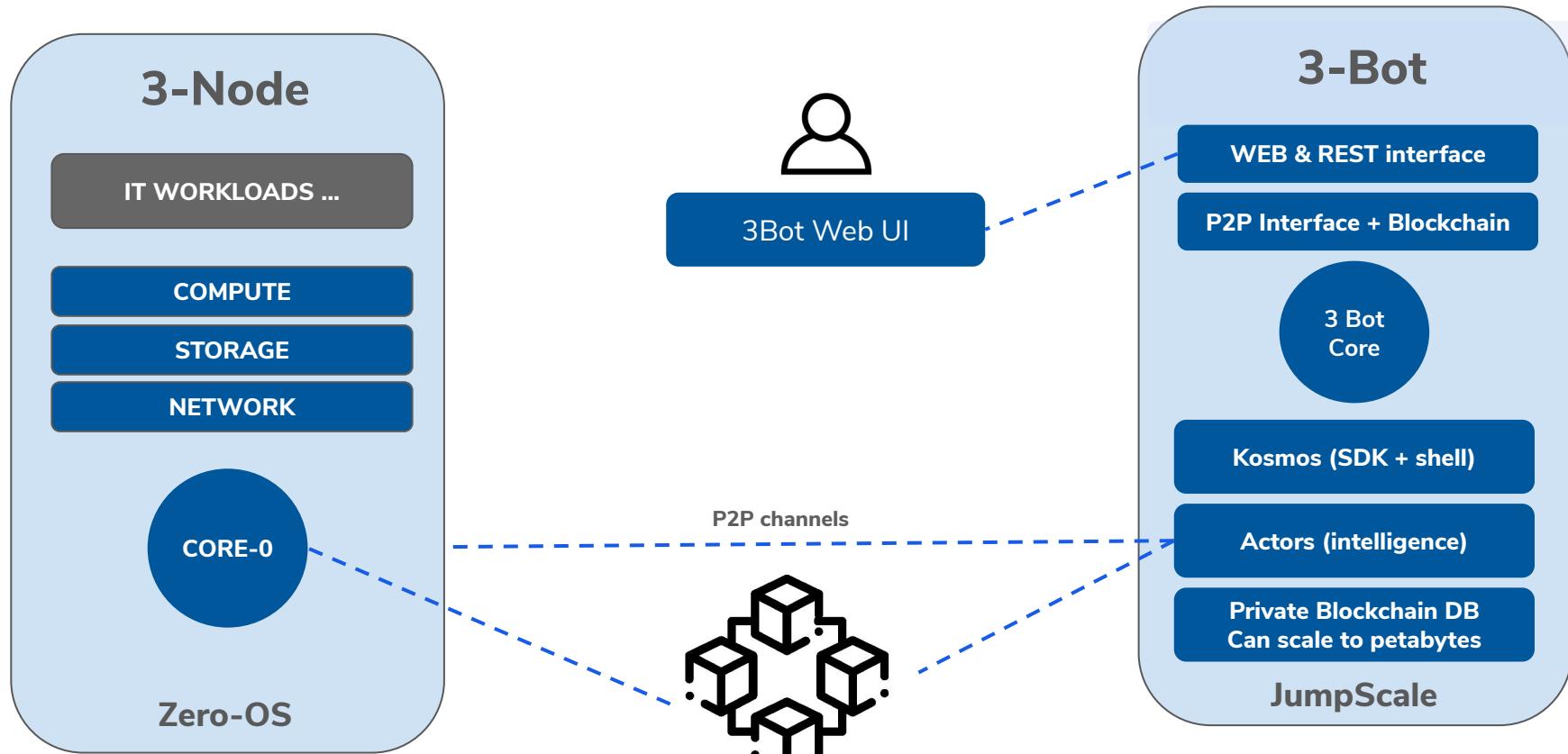
### P2PAGENT

Connects actors on the TFGGrid to talk to  
each other (e.g. digital twins)

Is queue & delivery mechanism for  
information with reliable delivery

client to server apps inside the  
ZMachine (acts on behalf of the internet  
user) for info coming from WebGW

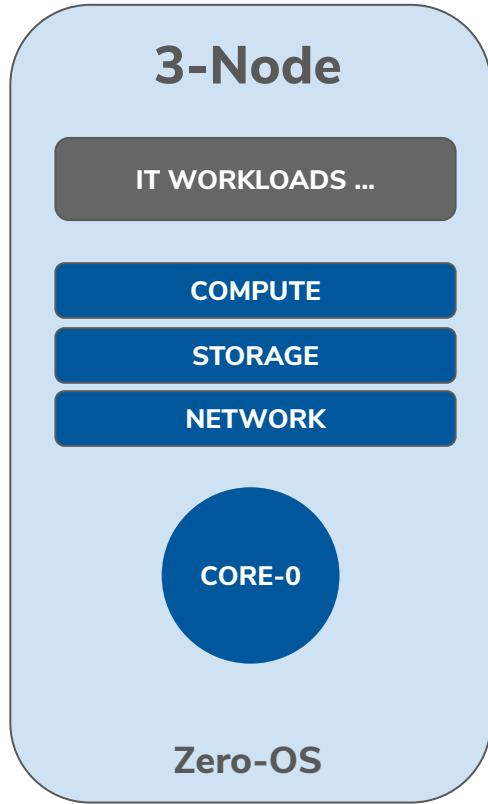
# THREEFOLD SMART CONTRACT FOR IT FLOW WITH 3BOT



Is for our v3.x series.

# IT SMART CONTRACT DEPLOYMENT

Secure Verified Multisigned Autheticated



Zero-OS = Secure

has no shell,  
cannot be used  
interactively

Human/Machine Consensus

## SMART CONTRACT LAYER

Monitoring Info  
Progress Report

P2P channels



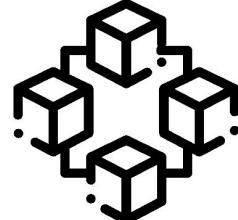
3Bot  
Virt Sysadmin  
OR  
IAC

Jumpscale Kosmos  
+ Actors

Private Data/Wallet

3 Bot = Private

Verify  
Signatures  
Origin, ...

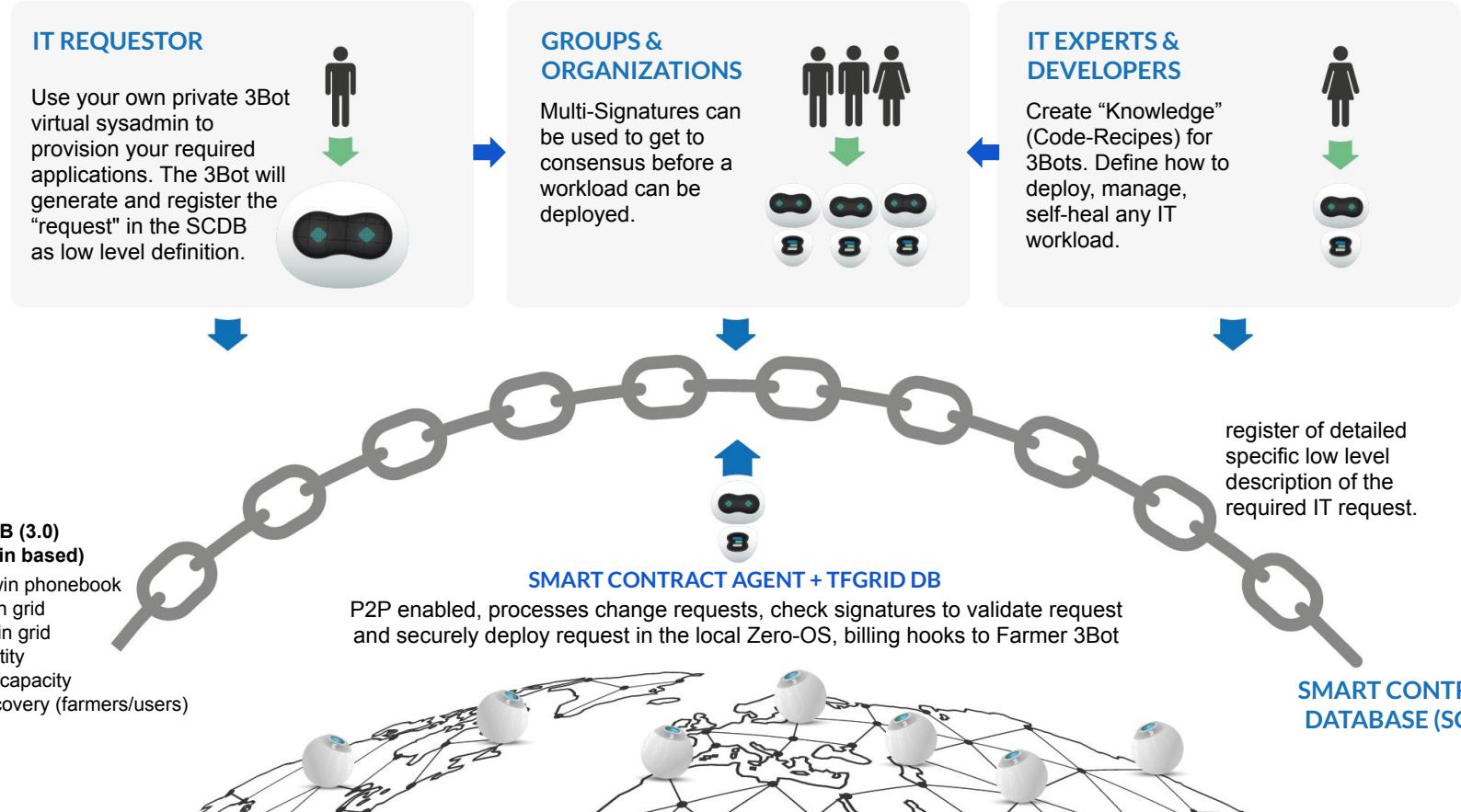


TFGRID BLOCKCHAIN

Is for our v3.x series.

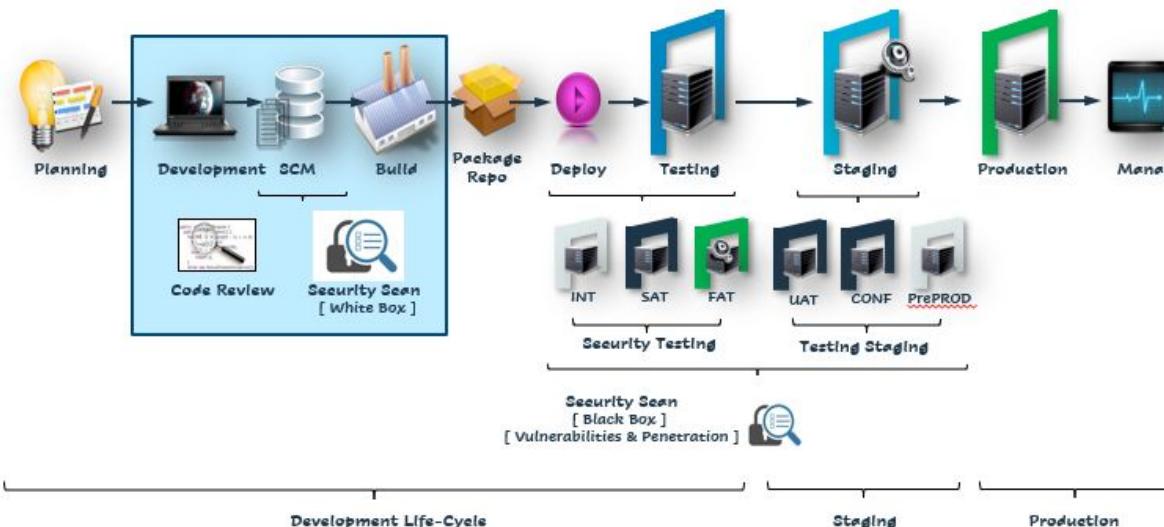
# “SMART CONTRACT FOR IT” PROCESS

Consensus driven and ultra secure way to deploy workloads on top of Zero-OS enabled 3-Nodes.

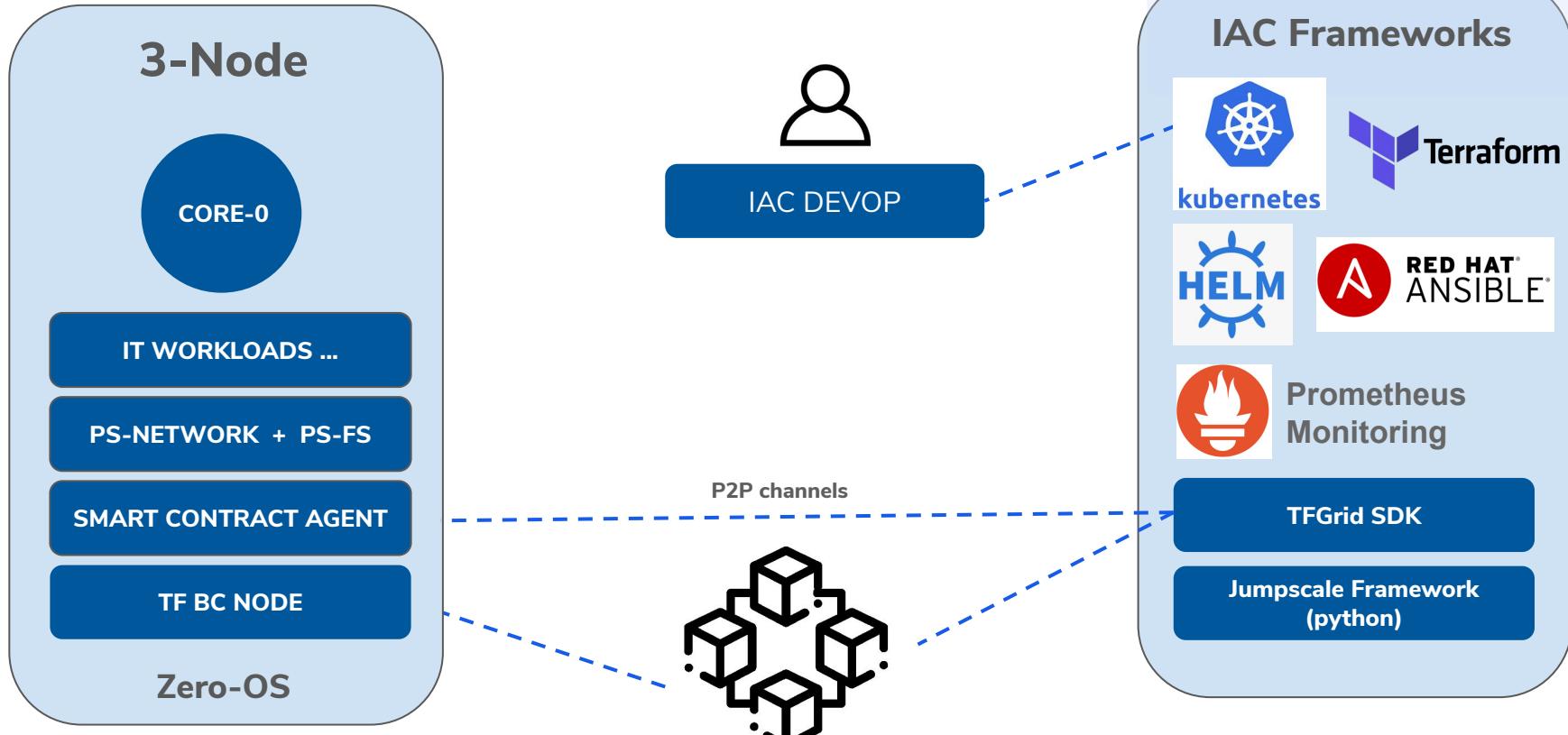


# DevOps = the future is here today. IAC = Infrastructure As Code

**DevOps** is a process framework that ensures collaboration between Development and Operations Team to deploy code to production environment faster in a repeatable and automated way. ... In simple terms, DevOps can be defined as an alignment between development and IT operations with better communication and collaboration.

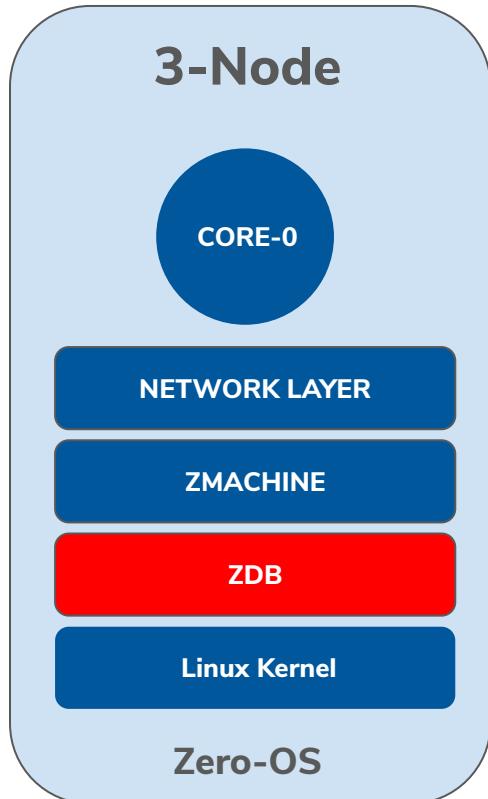


# THREEFOLD SMART CONTRACT FOR IT, IAC = Infrastructure As Code



Is for our v3.x series.

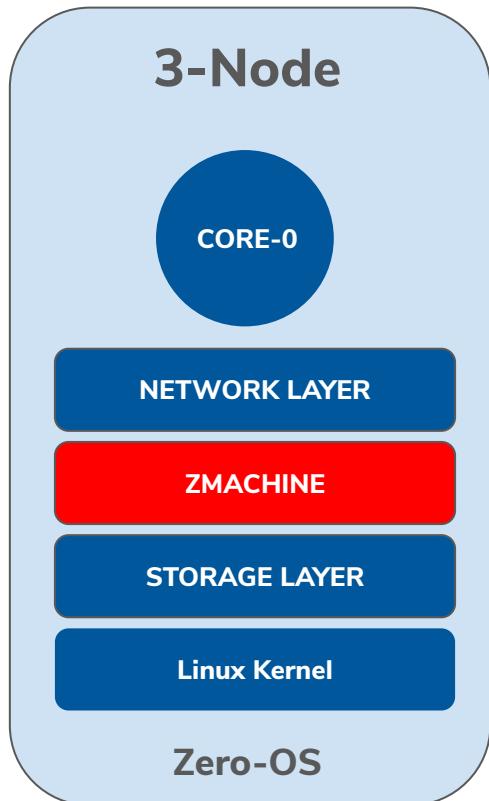
# ZERO-OS: PRIMITIVE FUNCTIONS: ZDB



## ZDB

- Backend Storage Engine
- Can do +50.000 transactions per/sec
- Can work on SSD & HD
- Optimized for easy (soft/green) operation on HD
- Works with reservations
- Always append store (can keep unlimited history)
- Master-Slave replication

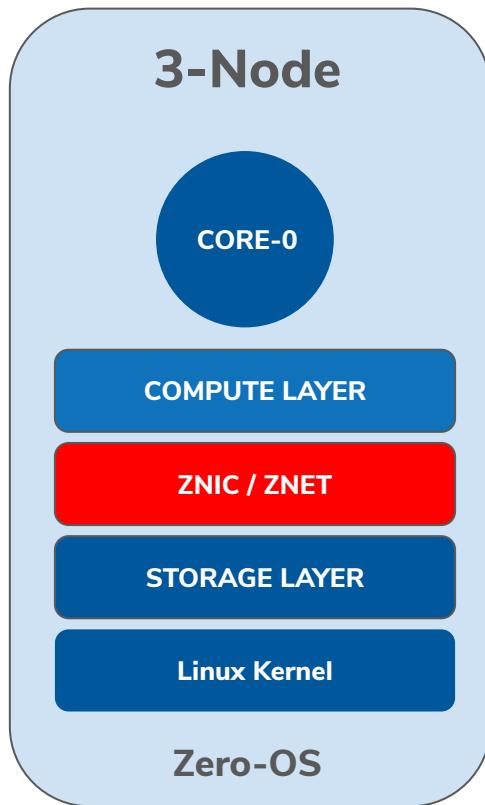
# ZERO-OS: PRIMITIVE FUNCTIONS: ZMACHINE



## ZMACHINE

- Runs any workload inside
  - Docker -> ZOS Containers, ...
- Super efficient container storage engine
  - Does not need Images
  - Dedupe Storage
  - Thin Provisioning
- Virtual Disk support (OEM only)
  - Block Storage
  - Replication Support
  - Thin Provisioning
- COREX support
  - Flexible process manager
  - Web & SSH support

# ZERO-OS: PRIMITIVE FUNCTIONS: NETWORK



## ZNIC / ZNET

- Interfaces
  - VXlan
  - IPv6
  - Bridge to Public Network
  - WireGuard
  - HTTP(S) proxy
  - ...
- end2endencrypted overlay network between all IT workloads as running in Zero-OS
- Scales to planetary levels.

# CoreX

- Container process manager
- Provide a web interface and a REST API
- Allow to watch the logs of your processes
- Or use it as a web terminal !

The screenshot shows a browser window with the address bar set to `/bin/bash (zero-os)`. The page content is a terminal session. At the top, it shows system statistics: load average (0.05, 0.01, 0.00), tasks (6 total, 1 running, 5 sleeping, 0 stopped, 0 zombie), CPU usage (%Cpu(s)), memory usage (KiB Mem: 3077636 total, 2209044 free, 153268 used, 715324 buff/cache, KiB Swap: 0 total, 0 free, 0 used, 2205964 avail Mem). Below this is a table of processes (PID, USER, PR, NI, VIRT, RES, SHR, %CPU, %MEM, TIME+, COMMAND) with the following data:

PID	USER	PR	NI	VIRT	RES	SHR	S	%CPU	%MEM	TIME+	COMMAND
1	root	20	0	25012	3968	3044	S	0.3	0.1	0:00.89	corex
7	root	20	0	24744	2992	2160	S	0.3	0.1	0:00.89	corex
8	root	20	0	36596	948	512	S	0.0	0.0	0:00.07	top
9	root	20	0	18508	280	0	S	0.0	0.0	0:00.00	bash
12	root	20	0	18508	1048	764	S	0.0	0.0	0:00.00	bash
15	root	20	0	36748	2804	2328	R	0.0	0.1	0:00.01	top

# FLIST FileSystem

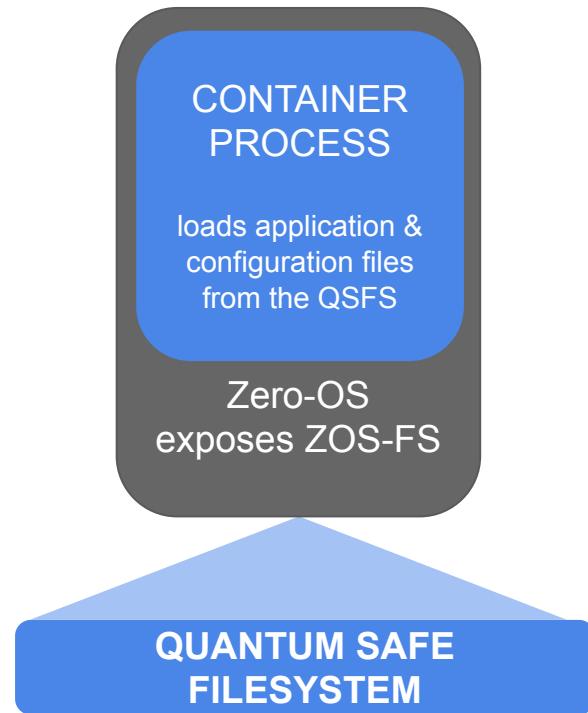
The screenshot shows a web-based interface for managing container images. At the top, there's a navigation bar with links for 'Zero-OS Hub', 'Upload', 'Customize', 'Docker', 'Homemade', and 'Search'. A 'Login' button is also present. The main content area is titled 'base-ubuntu:latest.flist'. Below the title, it says 'This archive was uploaded by [tf-official-apps](#)'. There are several sections: 'Source File' with a link to the file; 'Storage Address' with a link to 'zdb://hub.grid.tf:9900'; 'Archive Checksum (MD5)' showing 'e074c05e459c319fee2e498b3377d381'; 'Readme' with a link to 'Load the readme'; and 'Contents' which lists '586 directories, 2554 regular files, 186 symlinks and 0 special files.' followed by a long list of directory paths.

FLISTS = represents a very efficient way to distribute a de-duped container image with a bandwidth optimized transfer process and increased security by signed files.

Contains only metadata, not the full blob.  
Downloading dramatically improves bandwidth usage and download time.

Stored and made available on the fly in the “[hub](#)”, i.e. http server serving static files.

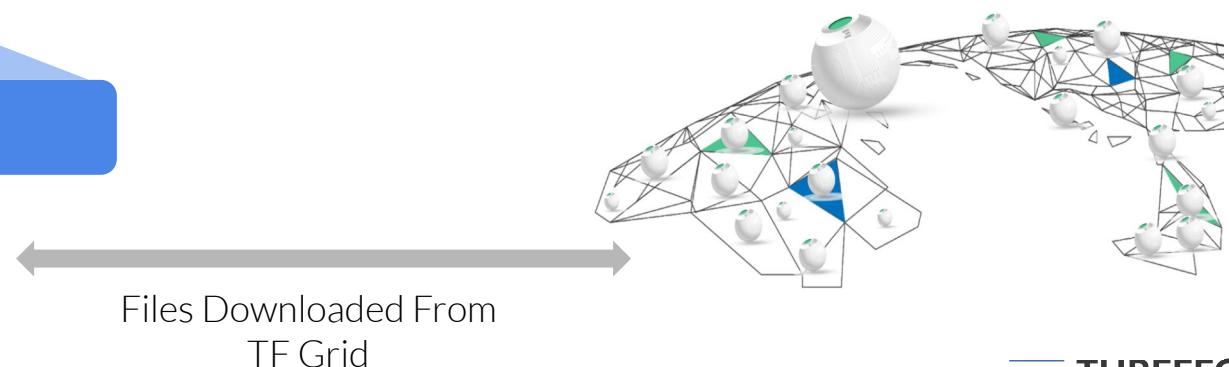
Up and running in seconds



Each file cut in part.  
Each part is fingerprinted.  
Each part is deduped.

ZOS-FS will only serve files which are guaranteed and identified in smart contract for IT.

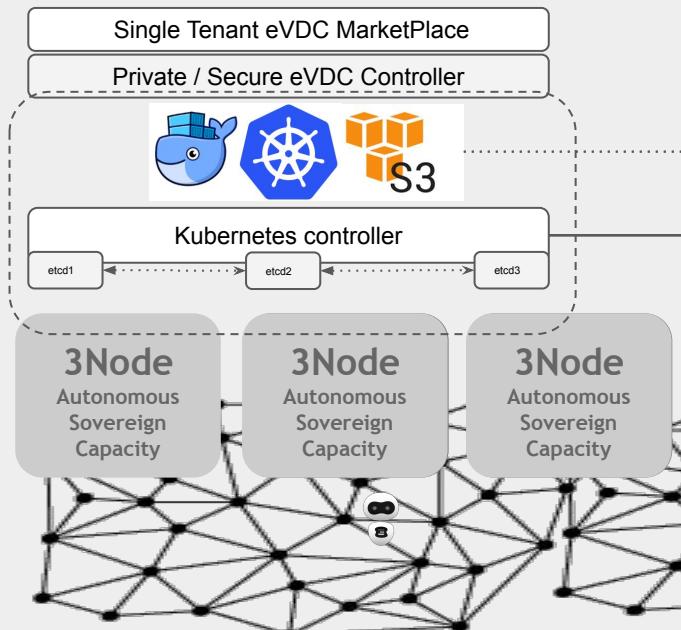
Means hackers cannot change file.



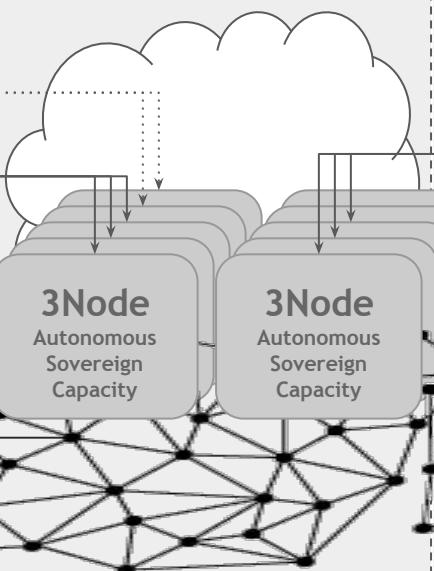
# Edge Virtual DataCenter = eVDC

On premise TF Grid capacity: Be your own eVDC provider

- Private owned 3Nodes operate eVDC
- Secure storage in on premise redundant capacity
- Secure networking to TF Grid backend capacity
- Zero proof data storage
- Quantum safe horizontal scaling storage solution
- Hybrid solution: on prem, TF Grid and eVDC providers

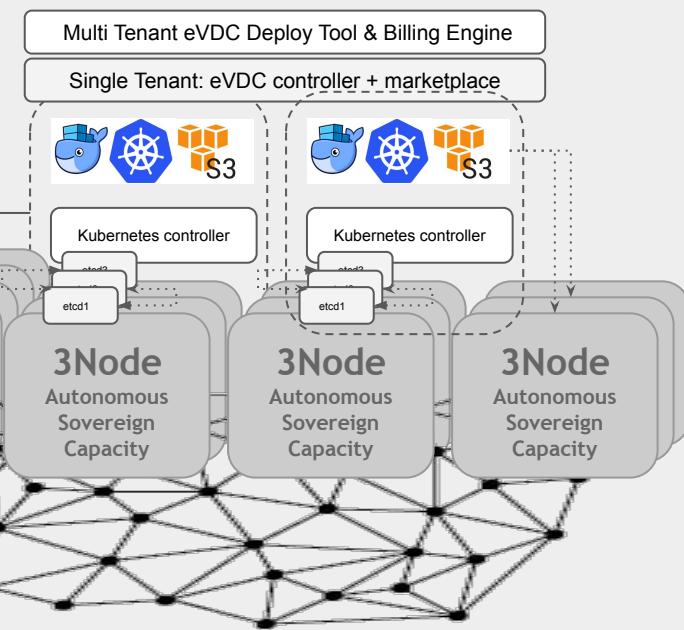


TF Grid: Scalable backend

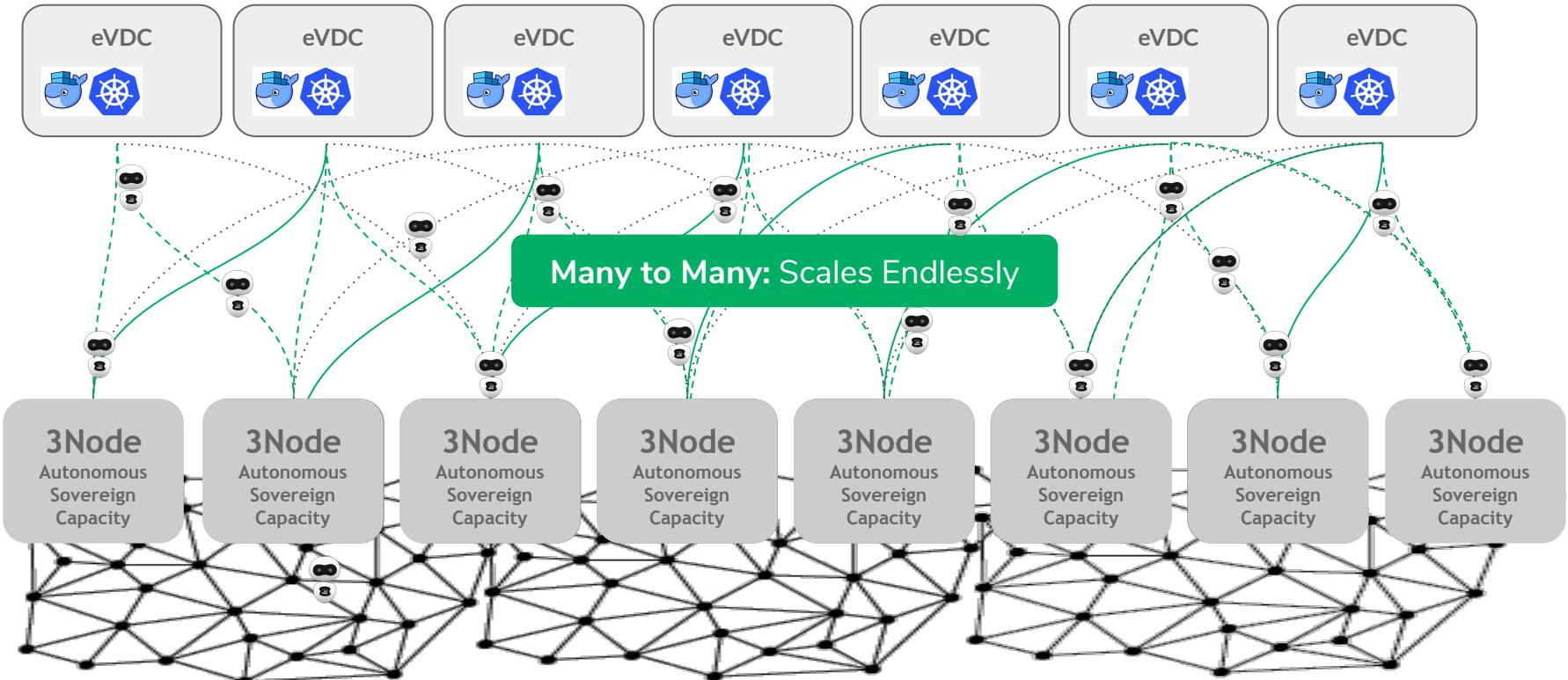


Known and **certified TF Grid Farmers** are eVDC providers

- Farmers meet quality and security standards
- Operate the eVDC controller - hassle free for end users
- Single tenant environments eVDC end user.
- Provide:
  - Zero proof data storage + Quantum safe
  - Hybrid solution: on prem and public



# eVDC ENDLESS SCALABILITY



# IT WORLD FORGOT HOW TO USE HARDWARE CAPABILITIES

30 years ago:  
Commodore 64



	1987	2015	improvement
memory capacity	1	8,192 MB	8,192
harddisk capacity	5	262,144 MB	52,429
cpu	7	11,059 MHZ	1,580
perceived performance	1	5	5
graphics (horizontal pixels)	640	2560	4

Today:  
Macbook Pro

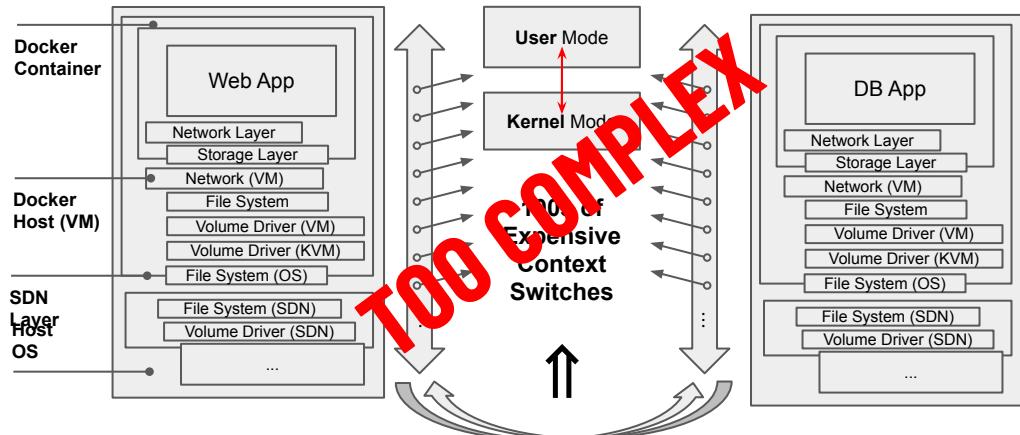


- **Hardware improved 10,000 times**
- **But, user features and performance improvement improved < 10 times**
- **Why?**
  - Education: Too influenced by IT vendors, too many abstraction layers
  - Large IT companies: Acquisition strategy forces them to integrate = complex layers
  - IT startups: Painkiller approach pays off
  - It's easier to build layers on top of other layers instead of rewriting

# OVERLY COMPLEX

## Abstraction Layers Compound Complexity

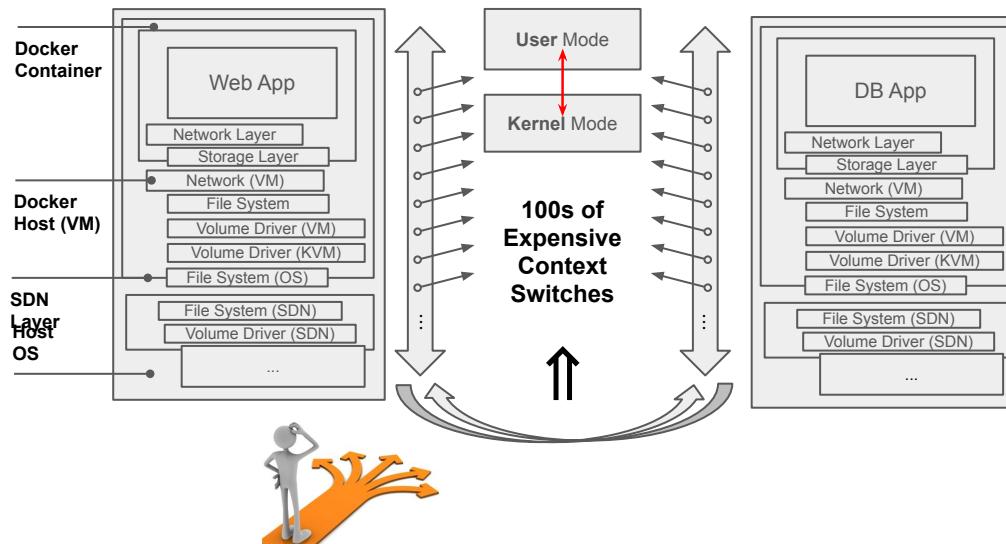
Too many abstraction layers  
**MEANS**  
loss in efficiency &  
performance  
**MEANS**  
increased cost of  
management and scalability  
of technology.



# LOWER AMOUNT OF CONTEXT SWITCHES

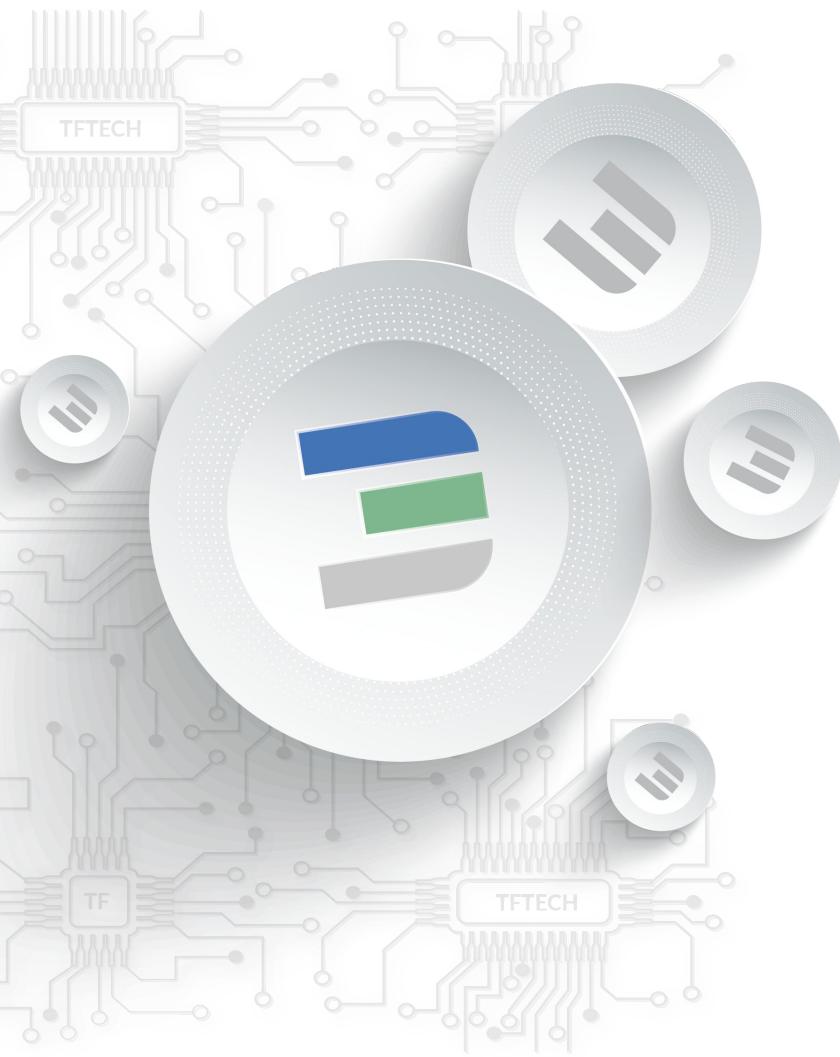
**Use HW more efficiently.**

- Context switching is the process of storing and restoring the execution state (context) of a process towards CPU.
- so that execution can be resumed from the same point at a later time...
- Each layer of abstraction involves multiple expensive user and kernel mode context switches
- Even a simple network interaction between 2 applications results easily in 100s of context switches



ThreeFold Tech's technology  
= a lot less abstraction layers.

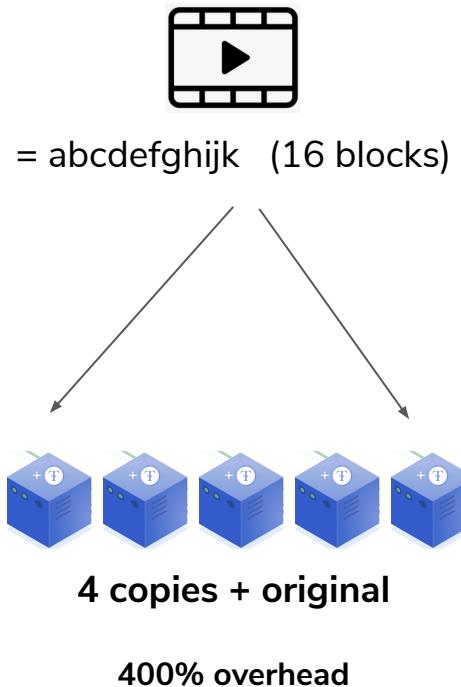
Loss of efficiency & performance:  
drives up the cost of scalability  
and management of technology  
layers



# QUANTUM SAFE STORAGE SYSTEM

# EXAMPLE CLASSIC DISTRIBUTED STORAGE

400% Overhead + 5x Bandwidth



## Requirements

- Reliable: allow any 4 nodes to be unavailable
- Data Privacy

## Solution

- Reliable: make 4 copies
- Data Privacy: encrypt

## Disadvantages

- 400% overhead because of 4 copies
- 5x bandwidth required to store on multiple locations
- Hacker only needs to have 1 copy = 1 location



= abcdefghijk (16 blocks)

# THREEFOLD QUANTUM SAFE STORAGE SYSTEM

## 10x more efficient

How to visualize?

$$a+2b+c+d+e+f+g+h+i+j+k = 100$$

$$a-3b-c+d+e+f+g+h+i+j+k = 4$$

$$-a+b-4c+d+e+f+g+h+i+j+k = -8$$

... do this 20 times. Now remember these equations.

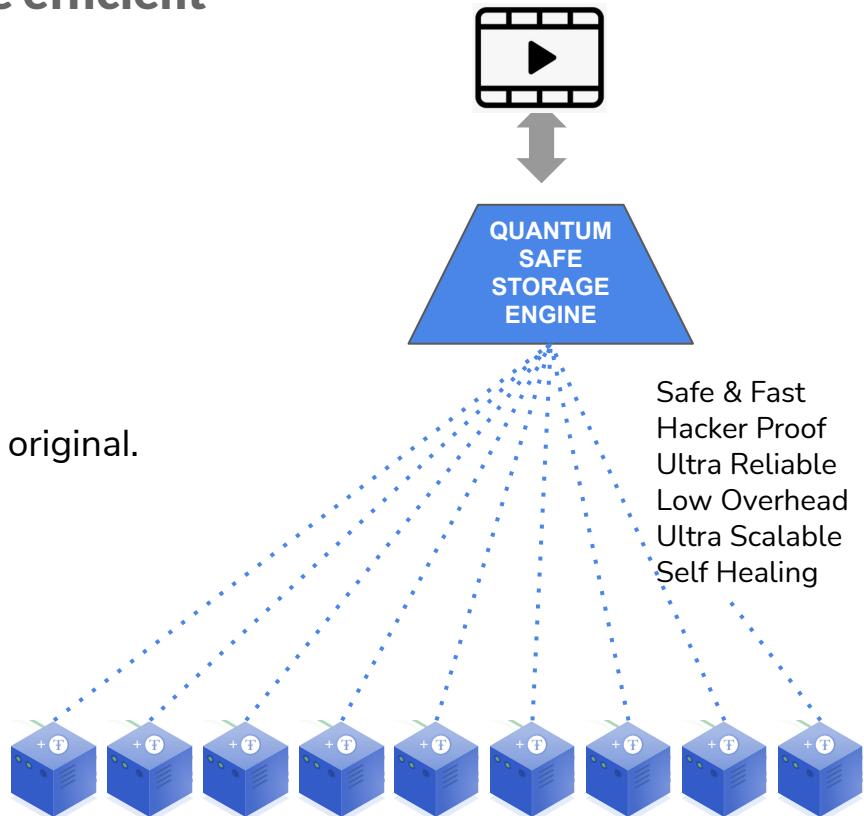
16 equations of the 20 allow you to calculate back the original.

**Super Efficient:** only 20% overhead

= 20x less overhead compared to classic systems

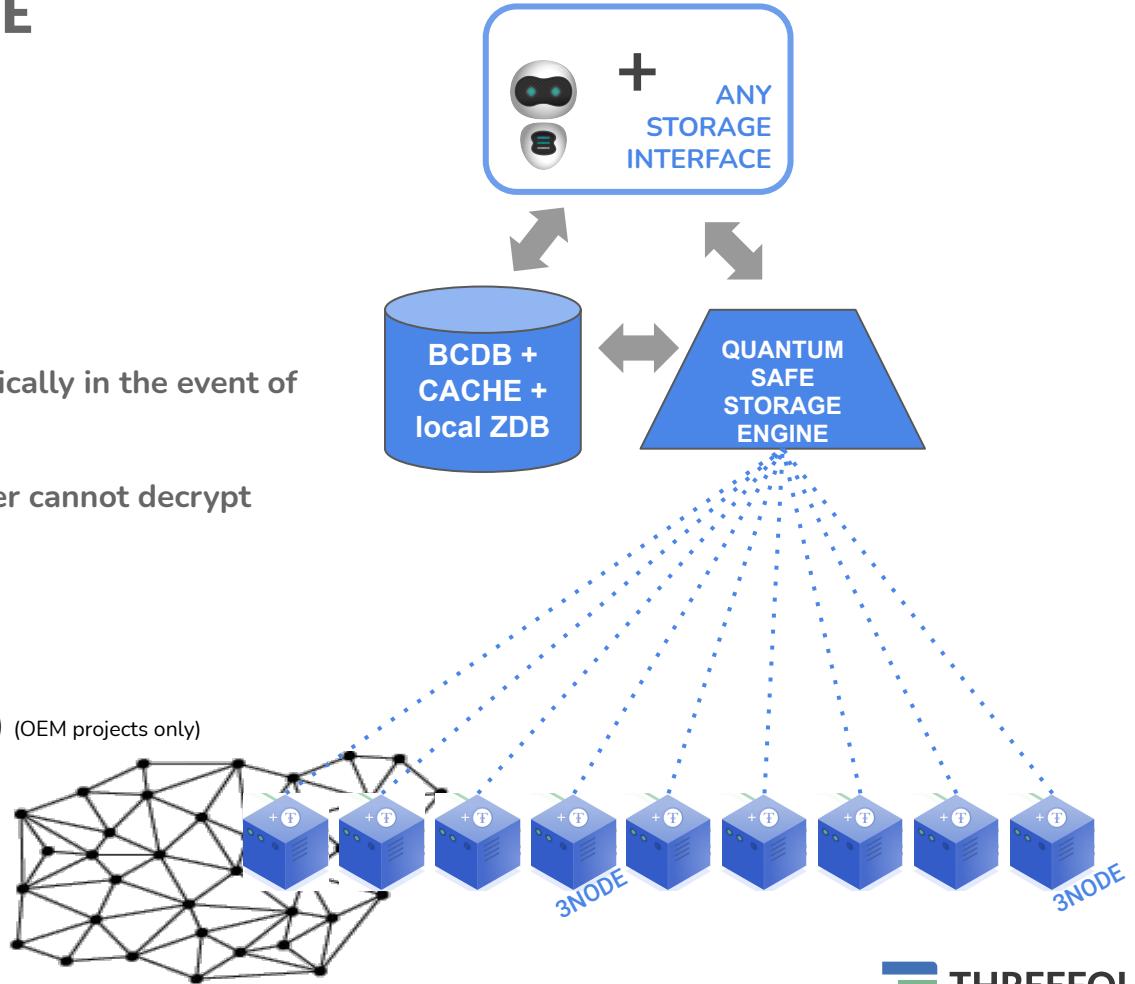
**Efficient:** Order of retrieval does not matter

**Hacker proof:** hacker needs to be on 16 locations physically + have encryption key before possible to reconstruct.



# QUANTUM SAFE STORAGE ARCHITECTURE

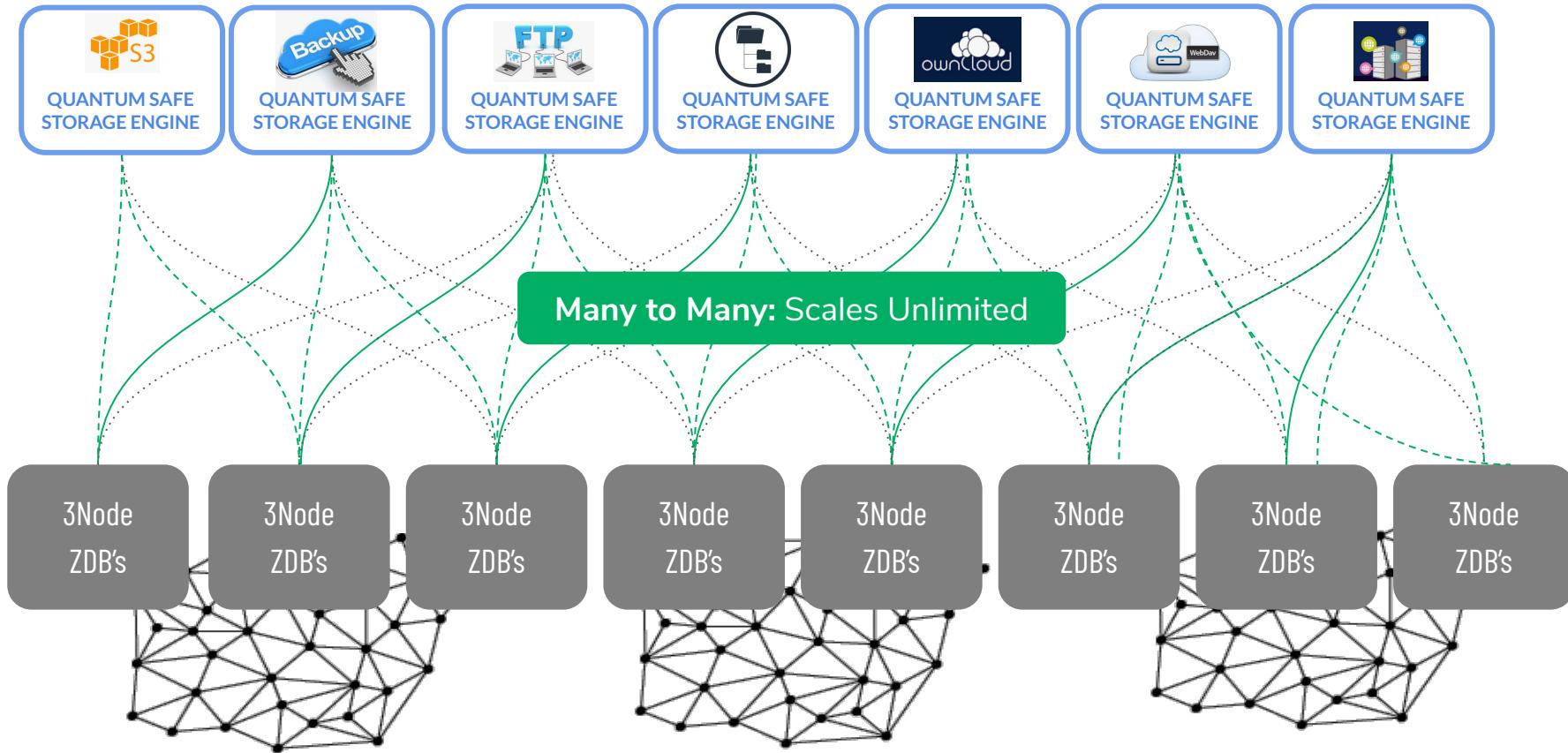
1. Safe & Fast
2. Hacker Proof
3. Ultra Reliable
4. Low Overhead
5. Ultra Scalable
6. Self Healing = recovers service automatically in the event of outage with no human intervention
7. Searchable & Auditable
8. Quantum safe, even a quantum computer cannot decrypt



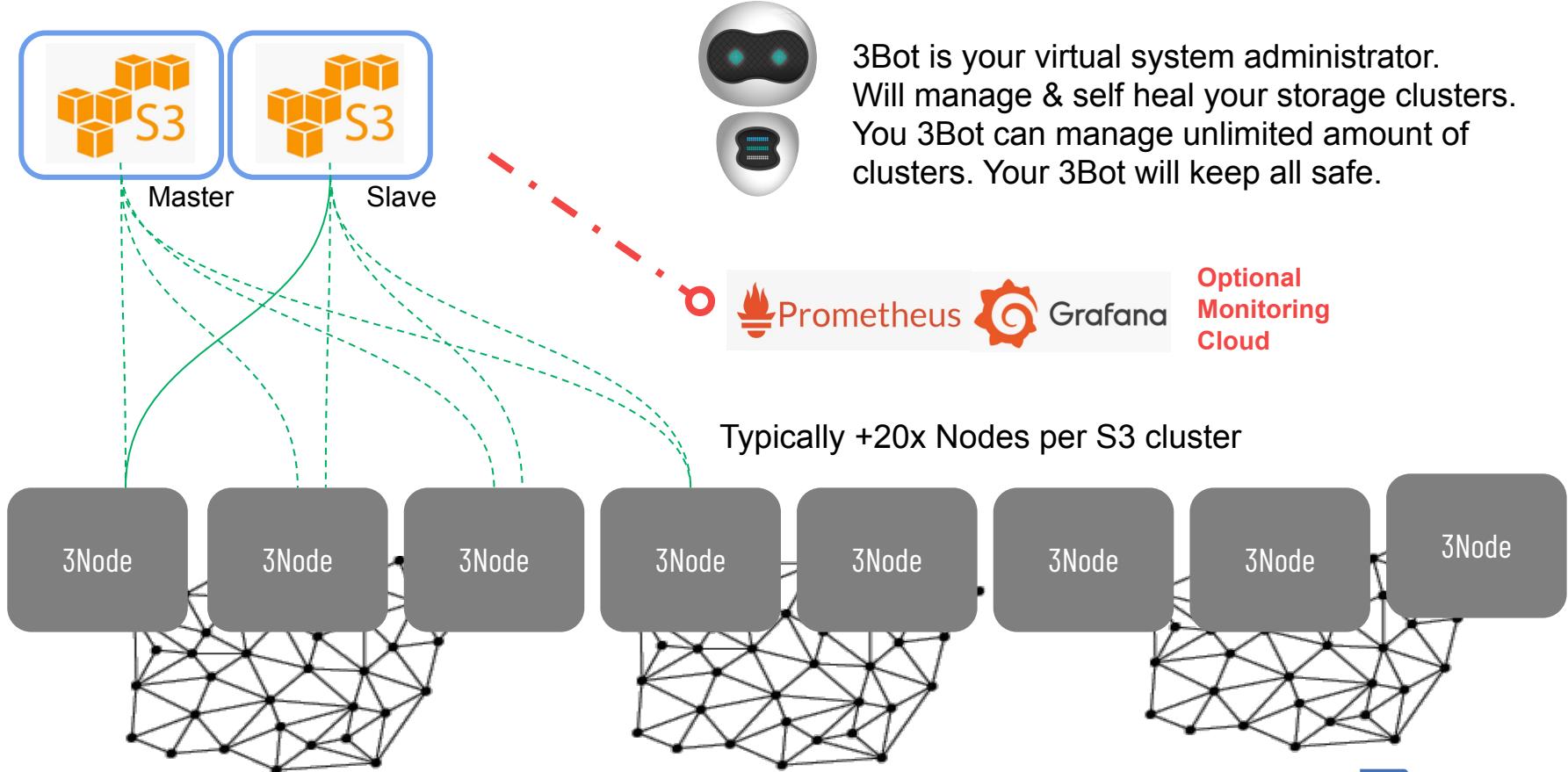
## Can be used as

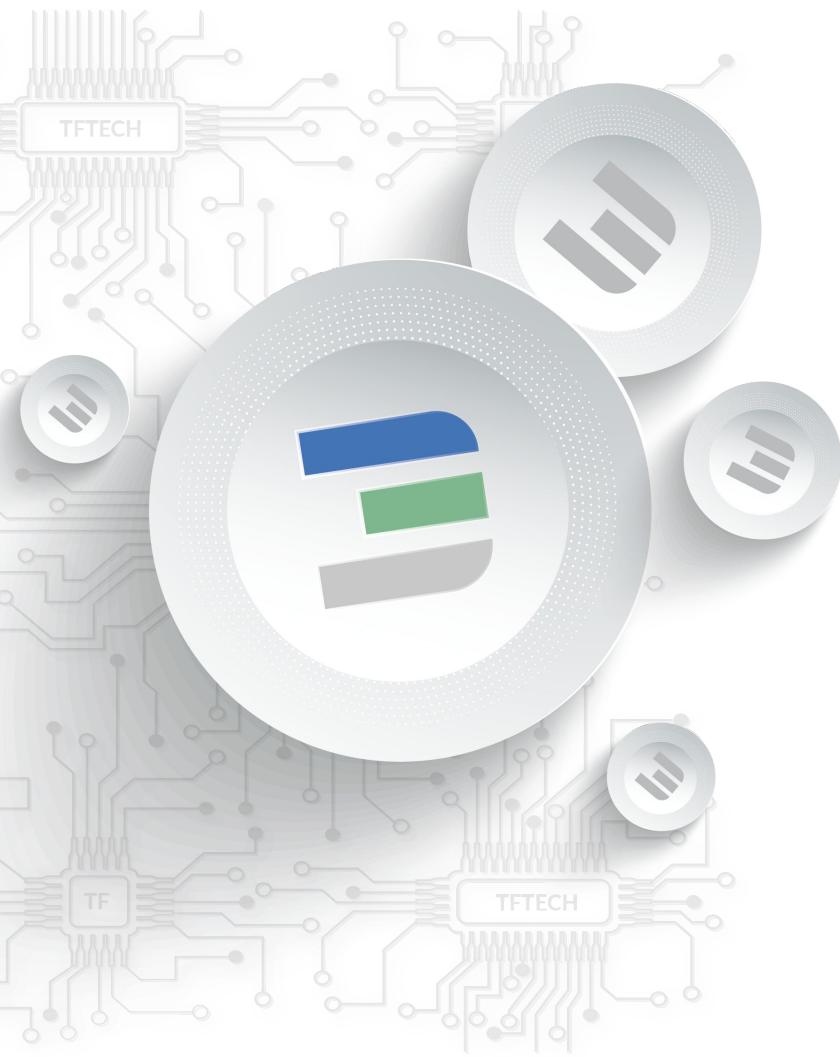
- archive system
- vdisk backend system (block device access) (OEM projects only)
- S3 storage system
- virtual filesystem (container FS)
- CDN = content delivery
- Blockchain Storage Backend  
(50x more efficient for 100 nodes)

# UNLIMITED SCALABILITY, PRIVATE & SECURE



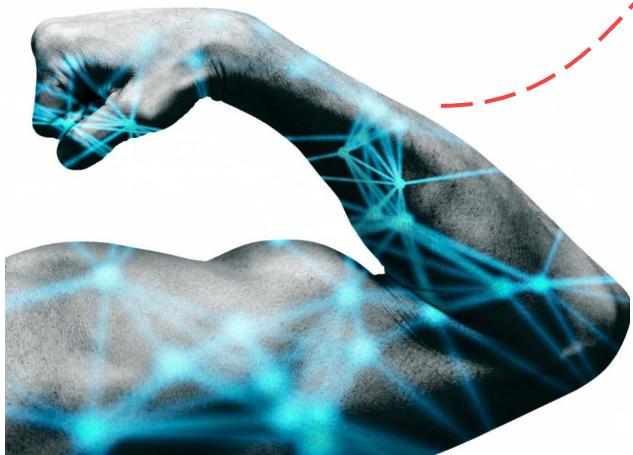
# SINGLE TENANT, SELF HEALING APPROACH





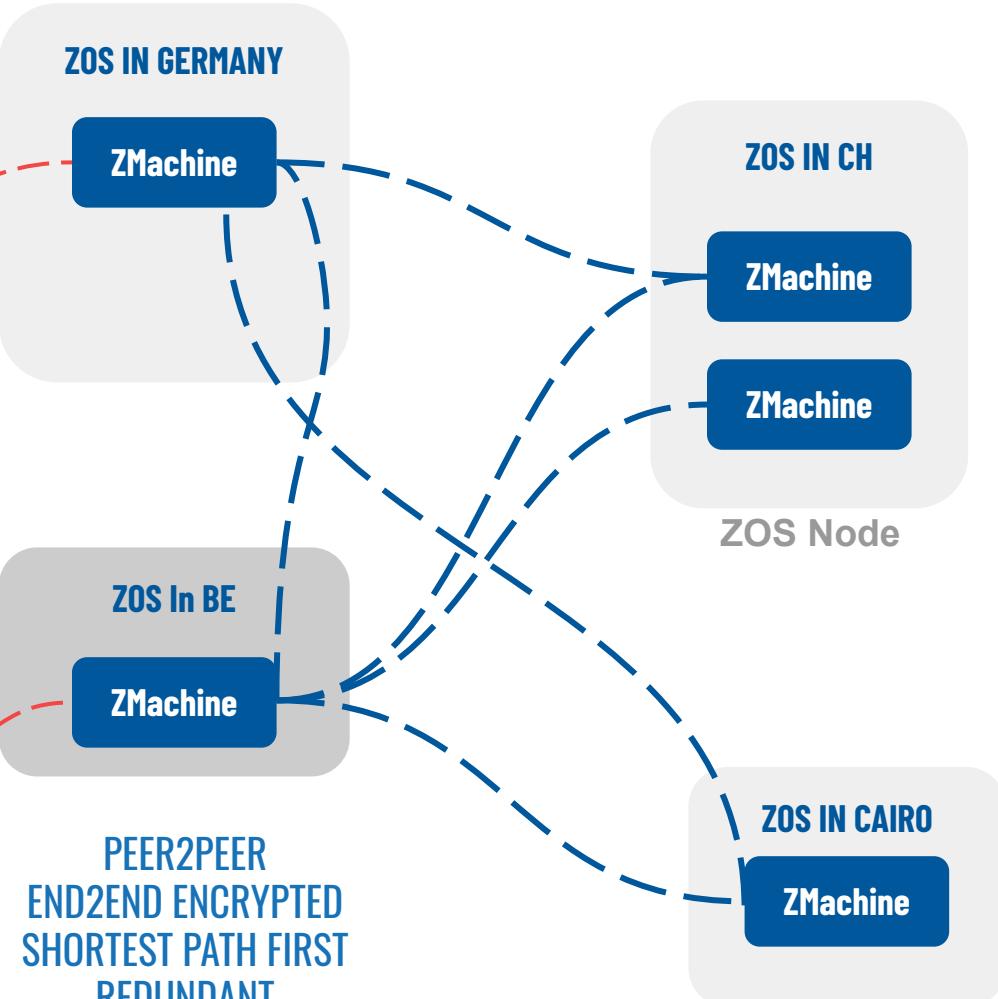
# PEER2PEER CLOUD NETWORK SYSTEM

# PEER2PEER CLOUD NETWORK LAYER



Bridges To  
Existing World

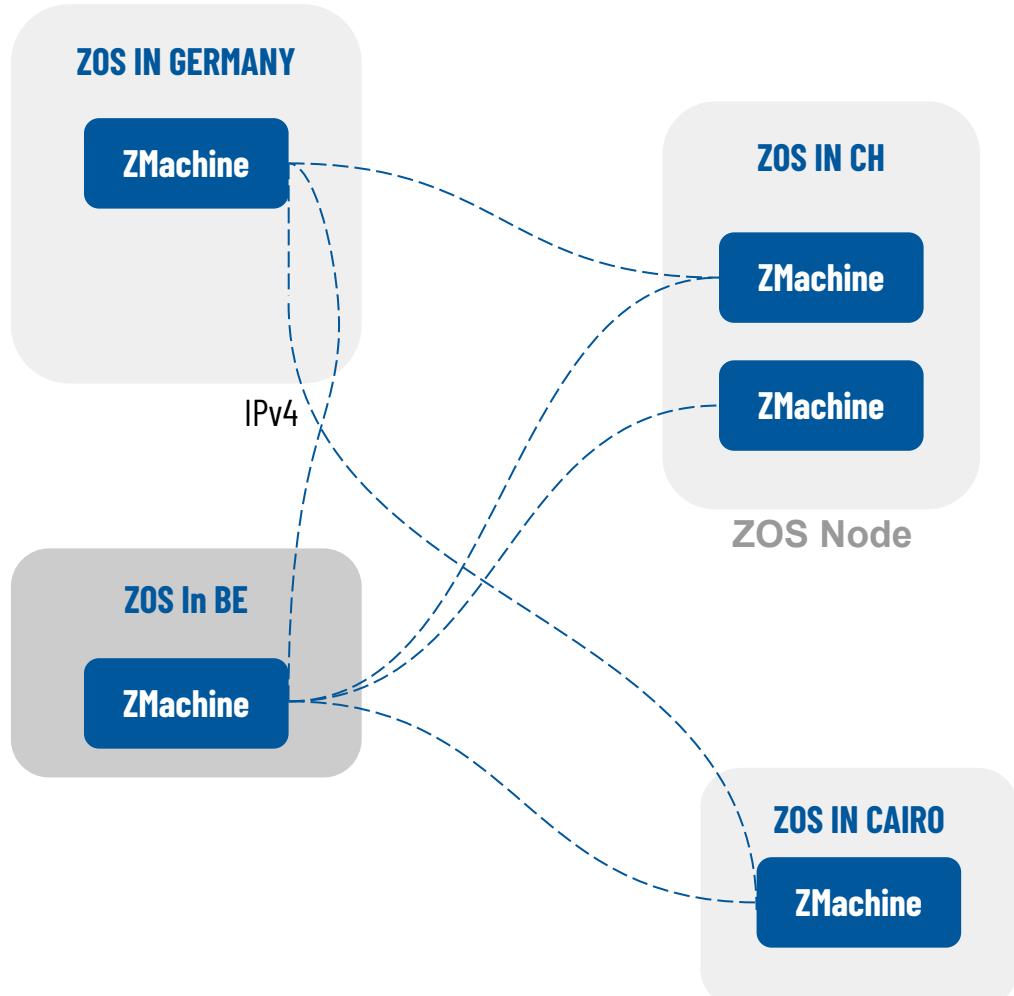
VXLAN  
LINUX BRIDGE  
VLAN  
IPSEC  
...

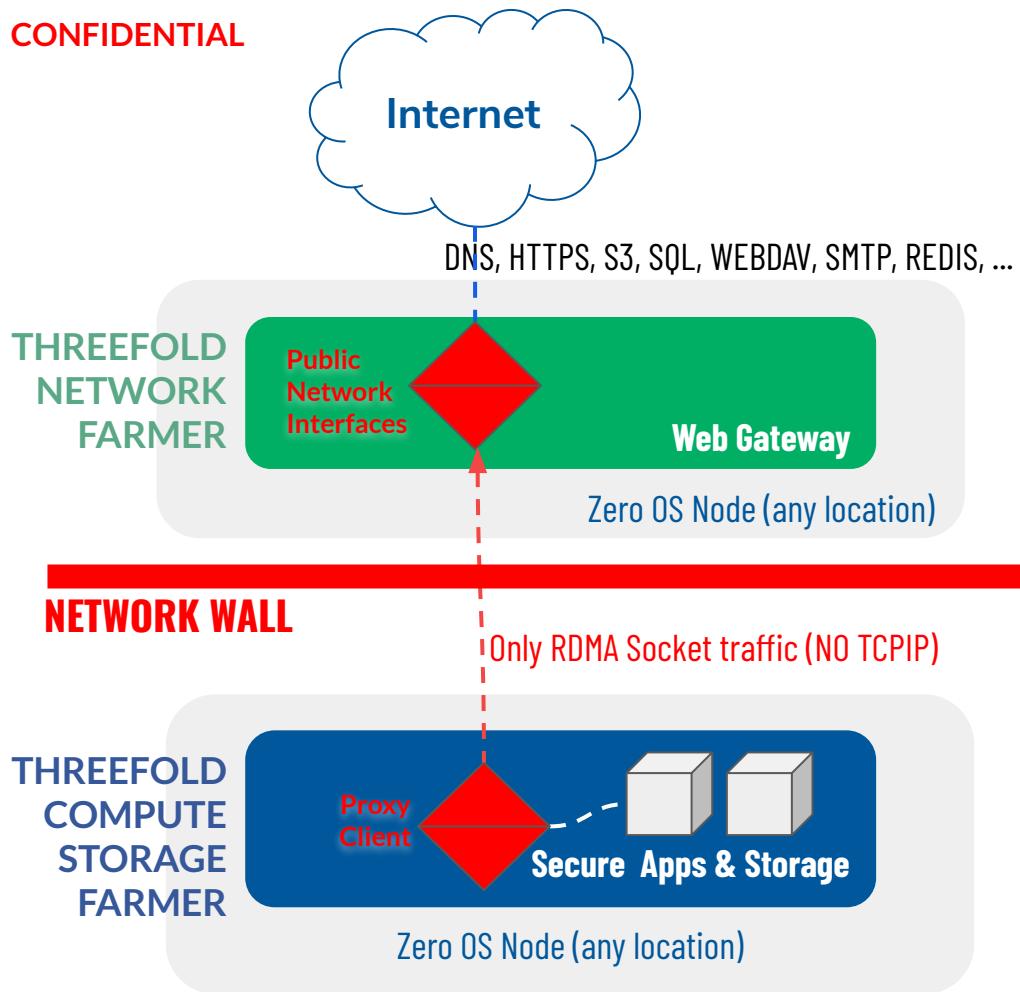


# PEER2PEER CLOUD NETWORK LAYER

## Peer2Peer Overlay Secure Network

- Connects all your containers
- Safe (100% encrypted)
- Fast (+1gbit/sec per node)
- Peer2Peer (shortest path chosen)
- Ultra Reliable
- Used to create Virtual Datacenters with it.
- **No connection to internet !**





# NETWORK WALL

100% separation between where compute workloads are and where services are exposed.

## Better Security

No IP (TCP/UDP) towards apps & storage = more security  
= no incoming network from internet

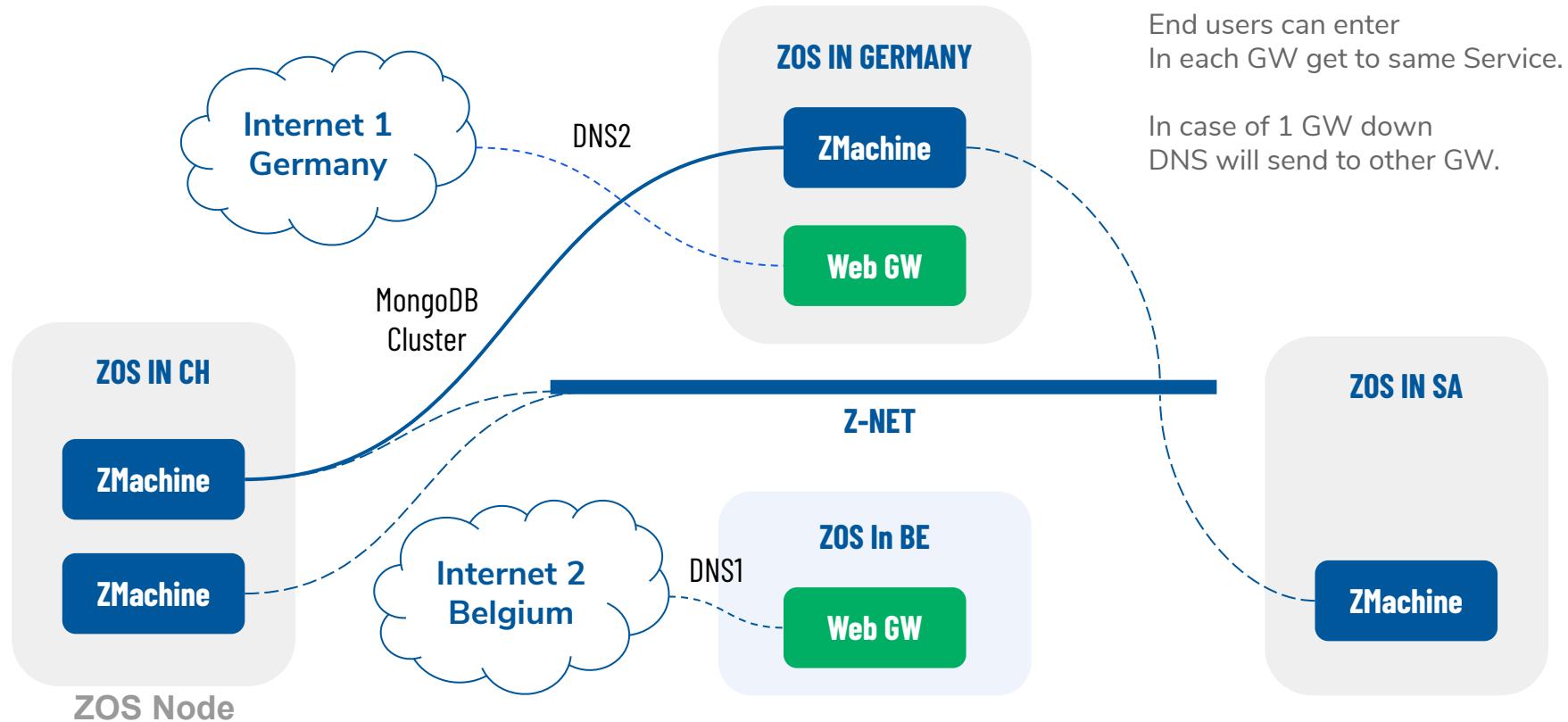
## Redundant

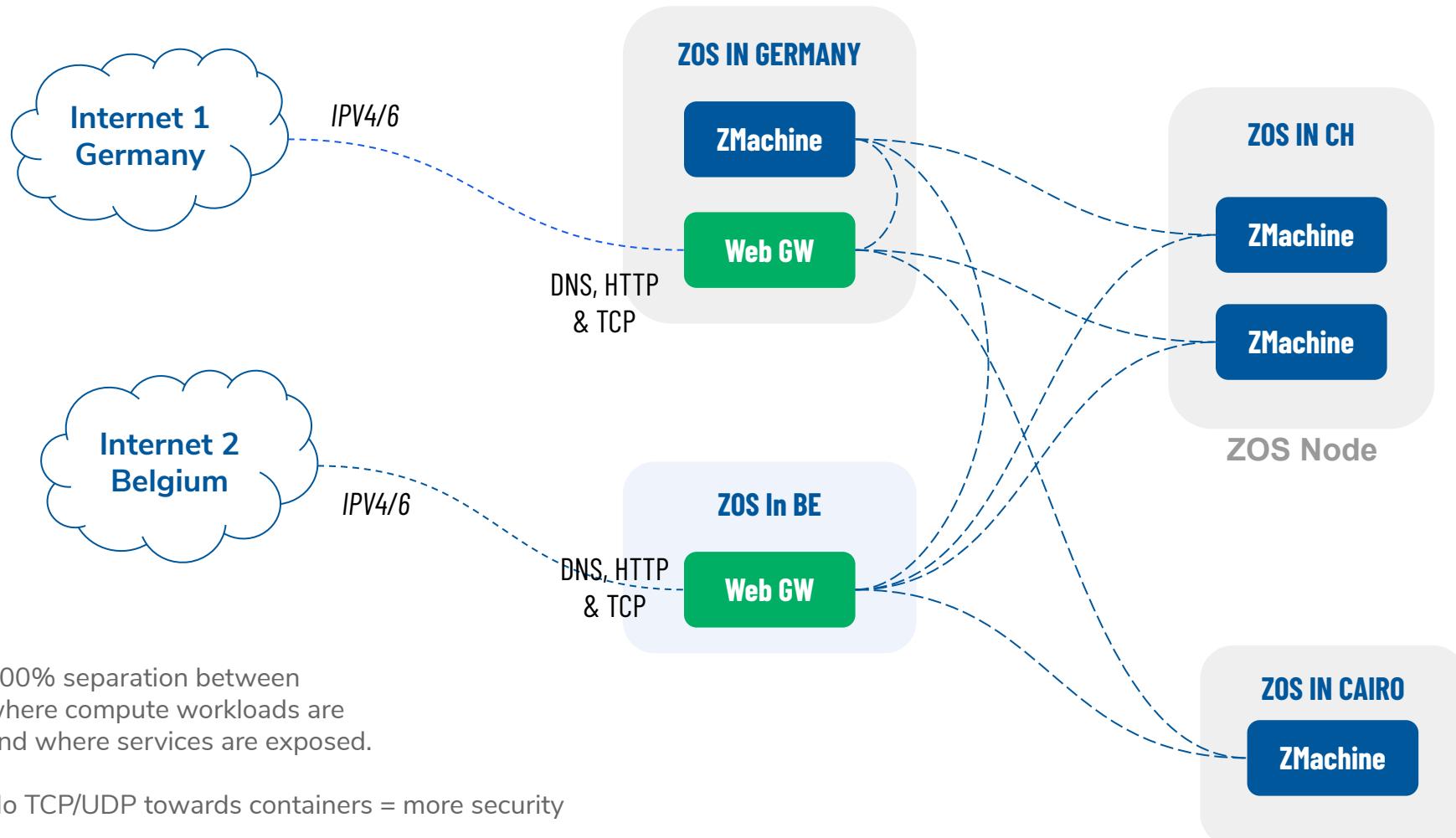
Each app can be exposed on multiple webgateways at once.

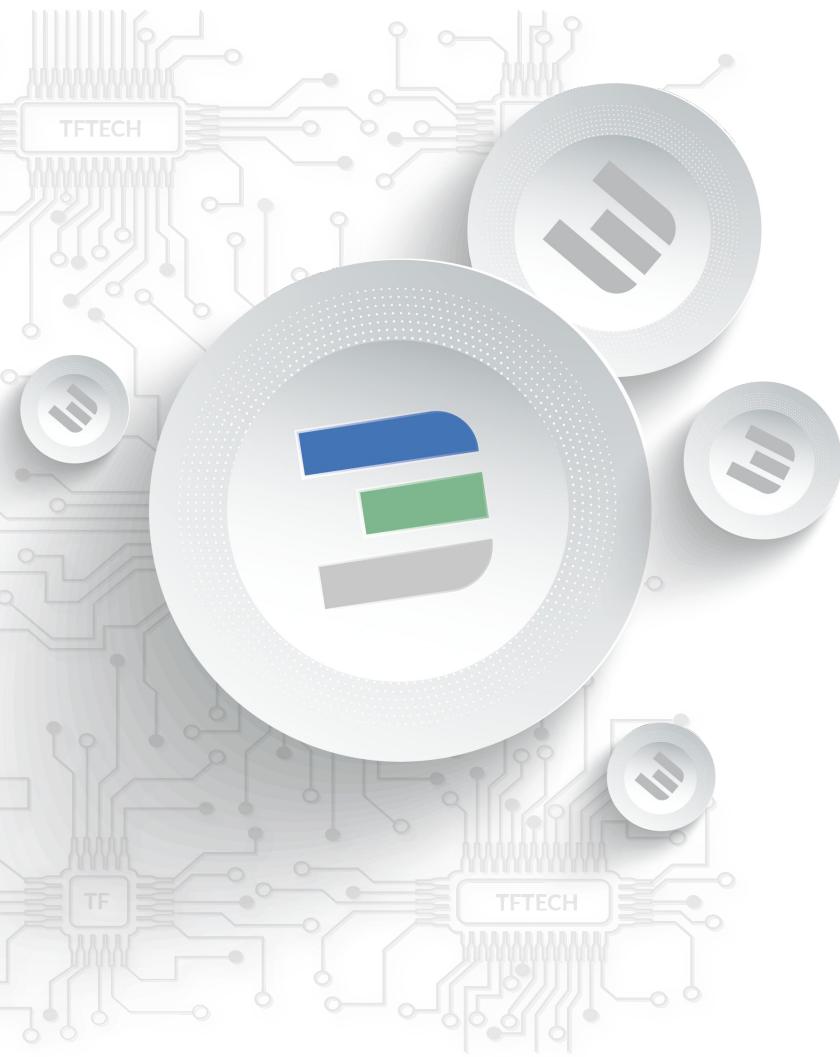
Support for many interfaces...

Resolves shortage of IPv4 addresses

# 100% REDUNDANCY & SELF HEALING POSSIBLE



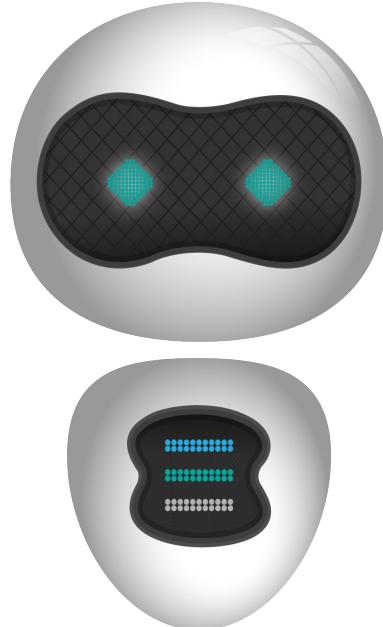




# DIGITAL TWIN

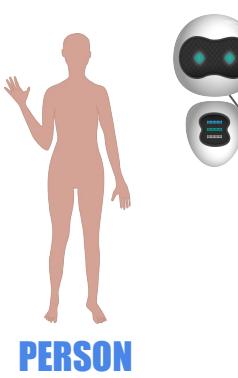
# DIGITAL TWIN

## Your Digital Avatar

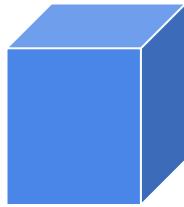


### DIGITAL TWIN (v1 in H1 2021):

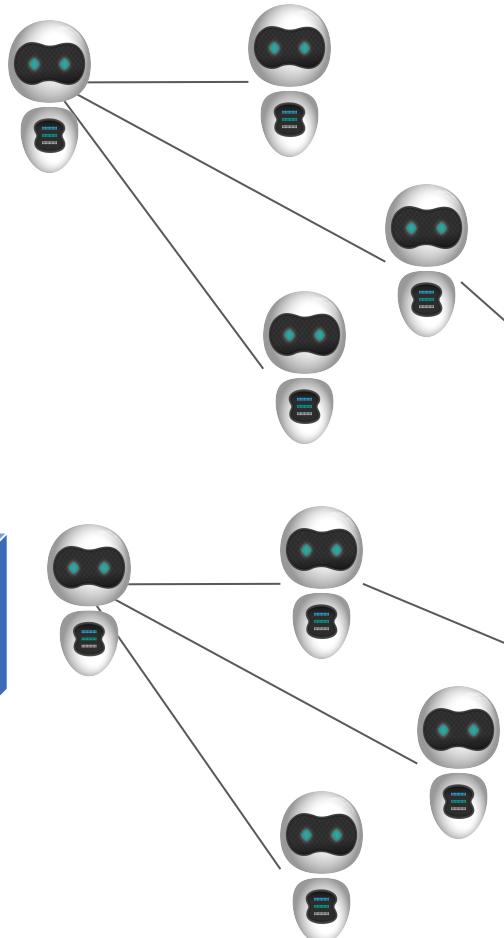
- Is your personal avatar for all your digital life.
- Your personal data store
- Integrated Wallet / FileManager / Chat
- Communicates over Planetary Secure Network (everyone P2P connected)
- **protocol.me** = interface for developers
- Can manage Petabytes of Storage
  - Video / Images / Documents
  - Structured Info (DB records)
- **Available Partner Experiences**
  - Office Documents (with P2P collaboration)
  - Decentralized Zoom alternative
  - P2P Digital Currency Exchange
  - Virtual Browser (running in grid)
  - Many more to come.



**PERSON**



**LEGAL ENTITY**

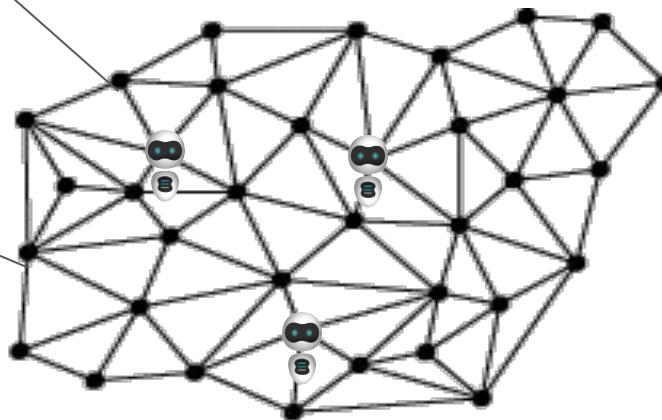


Each person or legal entity is represented by  
**ONLY 1 Digital Twin.**

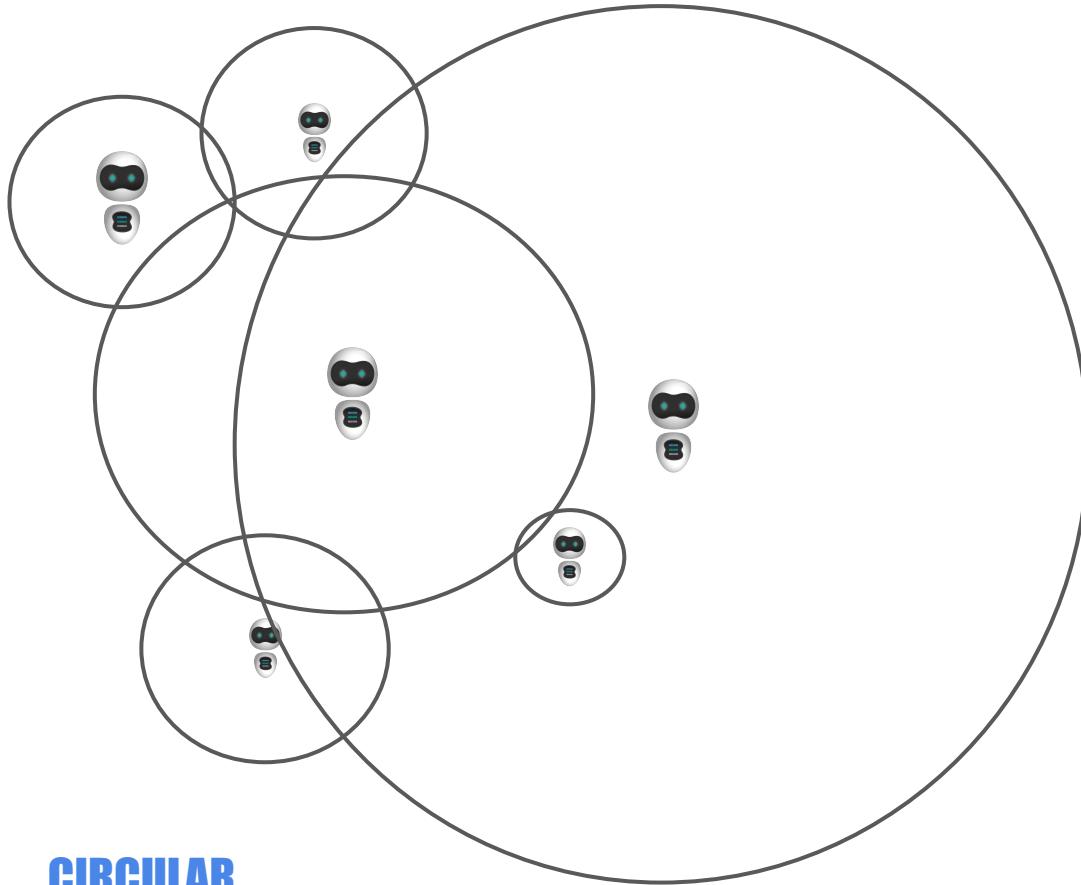
Digital Twins can own other Digital Twins.

Digital Twins are the actors in this digital world.

**Digital Twins are ultra secure,  
reliable & green.**



**ThreeFold Public  
or Private Grid**



## CIRCULAR AUTHENTICATION SYSTEM

Digital Twins are the center of the circles. Circles are regions of influence.

Information (data) is always shared with 1 or more circles.

The biggest circle = “the universe”

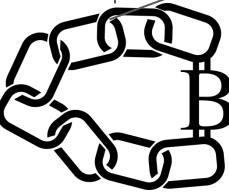
Circles can be

- your company
- your country
- your workgroup/department
- your street
- your group of friends

Search / Indexing of information is also organized & exposed to circles.



Digital  
Twin



TFGRID  
Blockchain

Phonebook of Twins

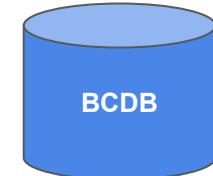
**MOST RELIABLE DB  
& STORAGE SYSTEM**

Blockchain DB

Auditability  
Tamper proof  
Search  
Fast



Digital  
Twin



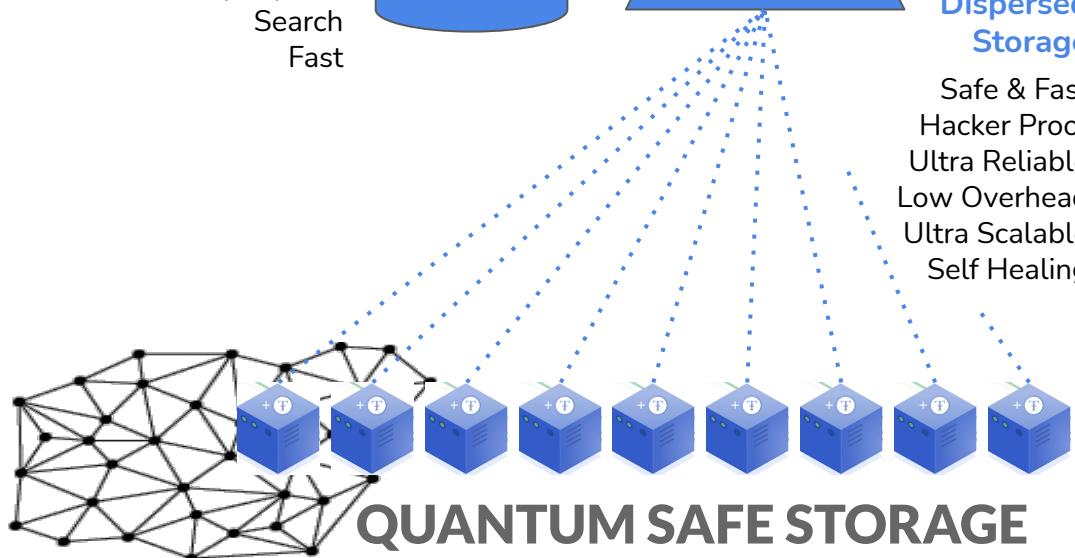
BCDB



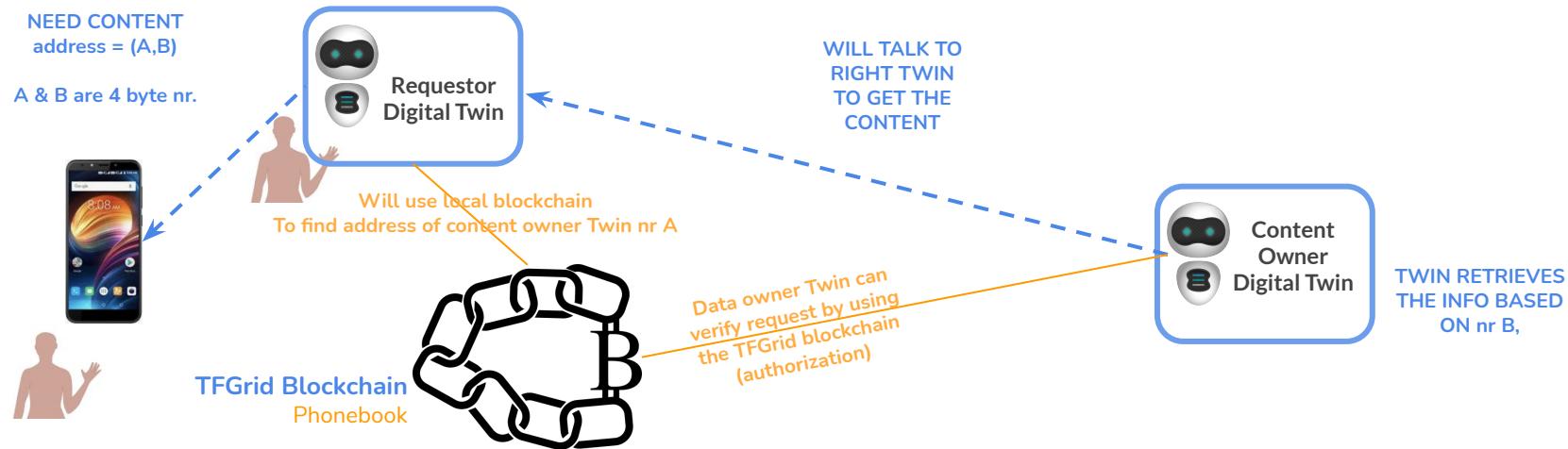
Quantum Safe  
Storage  
Engine

**Dispersed  
Storage**

Safe & Fast  
Hacker Proof  
Ultra Reliable  
Low Overhead  
Ultra Scalable  
Self Healing



# DIGITAL TWIN = planetary scalable data stor & information exchange all information in the world can be accessed by knowing only 2 nr's



**Efficient:** Only 8 bytes address

**Flexible:** Usable for any piece of content

database record, video, document, ...

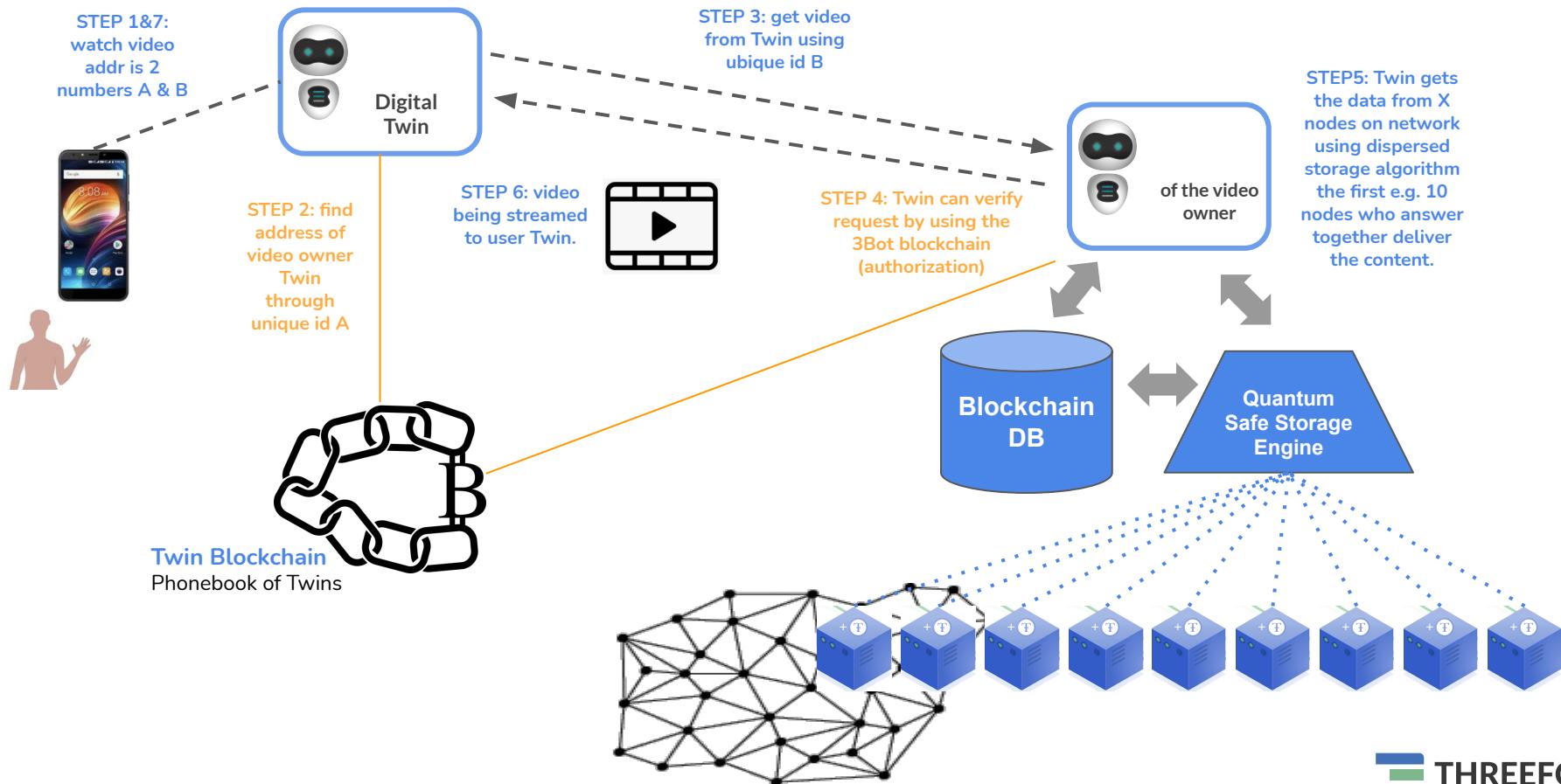
**Fast:** Only 1 x I/O operation required.

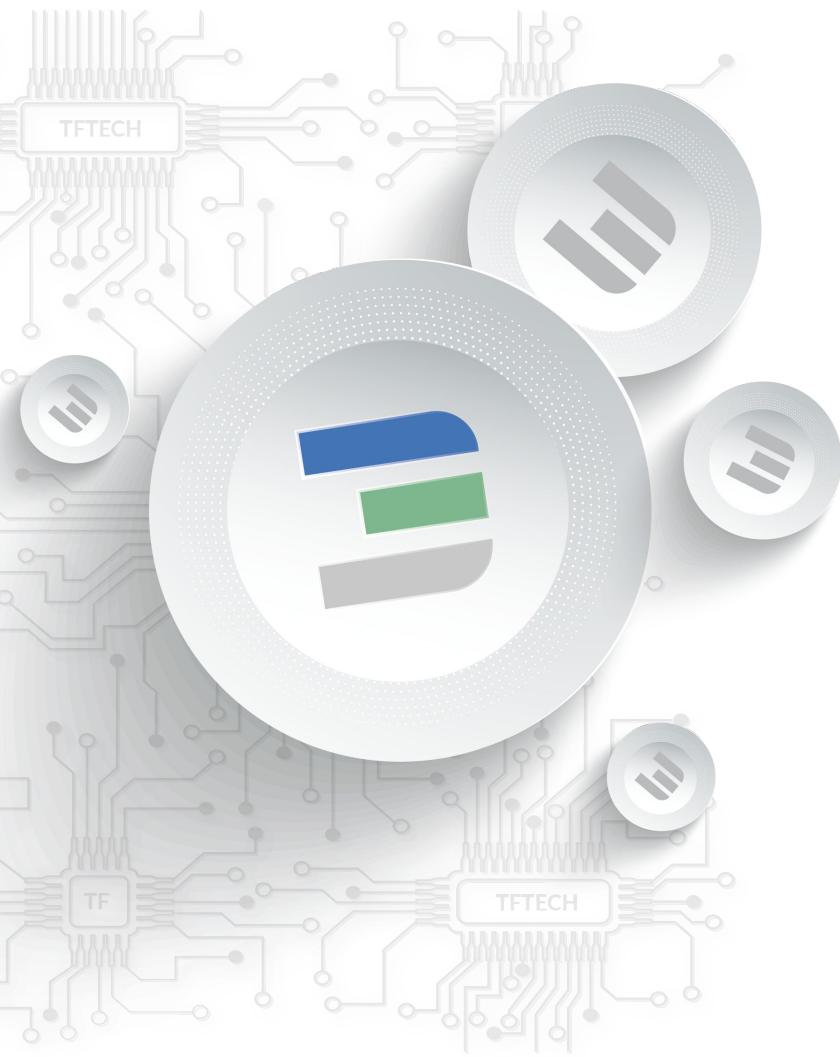
**Secure:** Every party can verify ownership, no SSL key exchange.

**Reliable:** Only 20% overhead for 4x redundancy level

can lose any 4 nodes holding some data at same time.

# DIGITAL TWIN STORAGE SOLUTION: 8 BYTE GLOBAL RETRIEVAL PROCESS

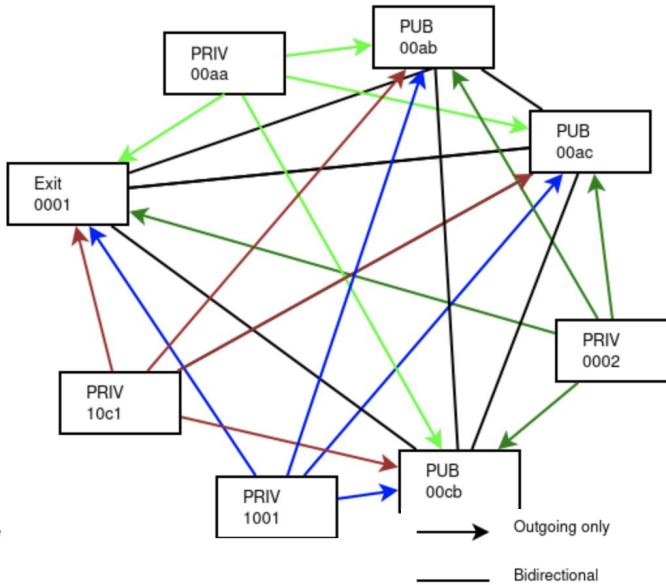




# Planetary Capable System

# PLANETARY NETWORK

## GLOBAL PEER2PEER NETWORK

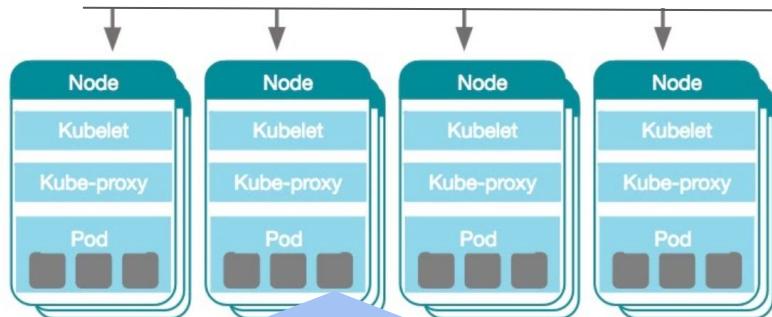


- **Overlay network** which lives on top of the existing internet or other peer2peer networks created.
- In a network, **everyone is connected** to everyone.
- **End-to-end encryption** between users of an app and the app running behind the network wall.  
Each user end network point = **strongly authenticated &** uniquely identified independent of network carrier used.
- No need for centralized firewall or vpn solutions, this is **circle based networking security**.

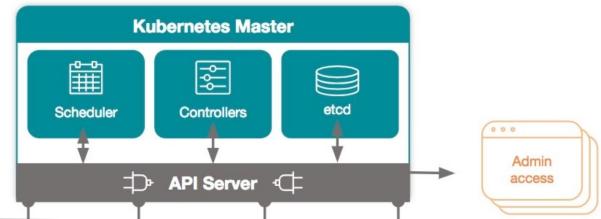
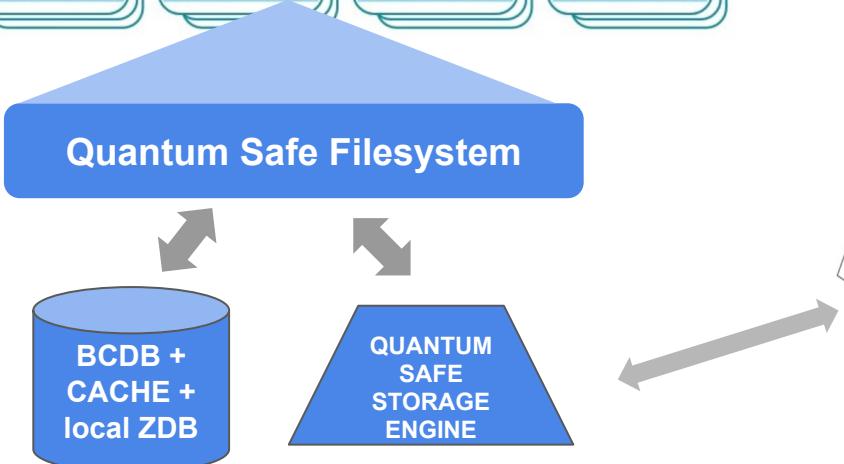
### Benefits :

- finds shortest possible paths between peers
- Full security through end-to-end encrypted
- allows for peer2peer links like meshed wireless
- can survive broken internet links and re-route when needed
- resolves the shortage of IPV4 addresses

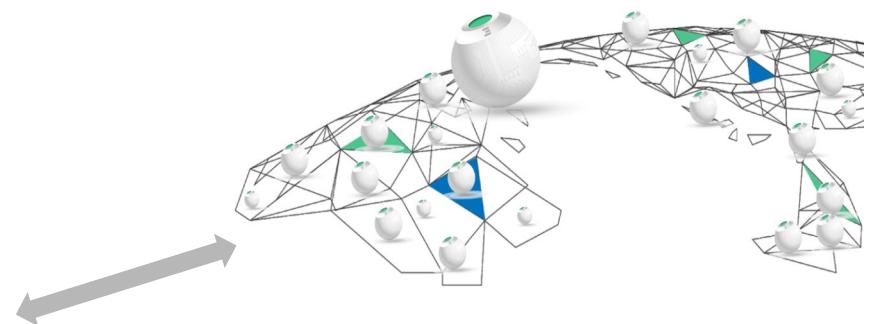
# QUANTUM SAFE FILESYSTEM IN ANY KUBERNETES CLOUD



encryption  
& key mgmt  
only at  
client side

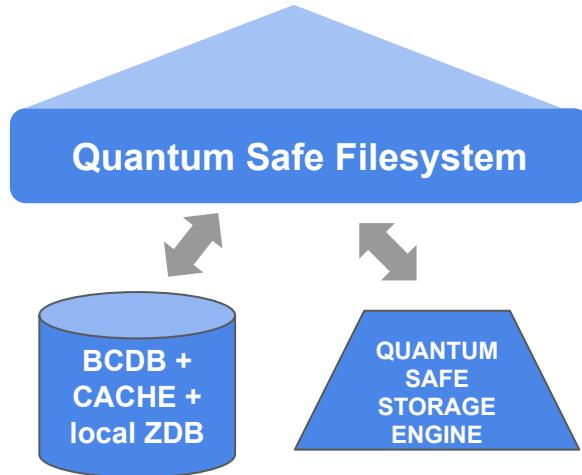
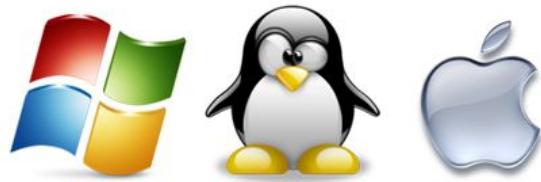


Unlimited scalable filesystem.  
stored in quantum safe way  
on top of a public or private TFGrid.



# QUANTUM SAFE FILESYSTEM ON LINUX, WINDOWS, OSX, ...

Unlimited scalable filesystem.  
stored in quantum safe way  
on top of a public or private TFGrid.

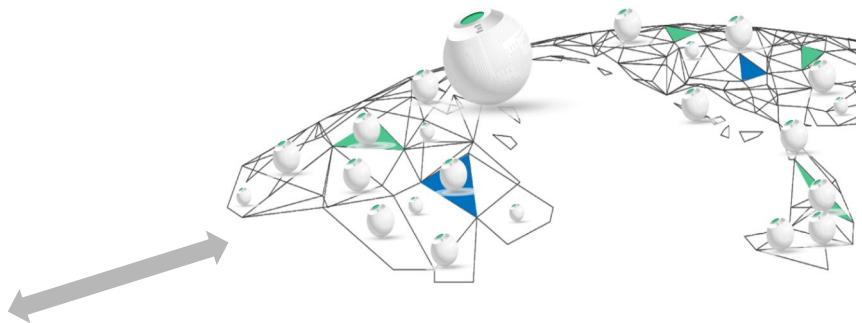


encryption  
& key mgmt  
only at  
client side

Caching on client.

Validation on DGB blockchain.

Planet scalable.



# ANY STORAGE DRIVEN APP CAN BE USED ON TOP OF QUANTUM SAFE FS

