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Blockchain-based Fully Distributed Cloud Computing

Inria

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The Promise of Ethereum

- *Dapps: Distributed Applications running on the Blockchain*

Blockchain offer limited computing resources : storage is expensive, slow EVM, high tx latency etc.

How to satisfy compute/data-intensive DApps ?

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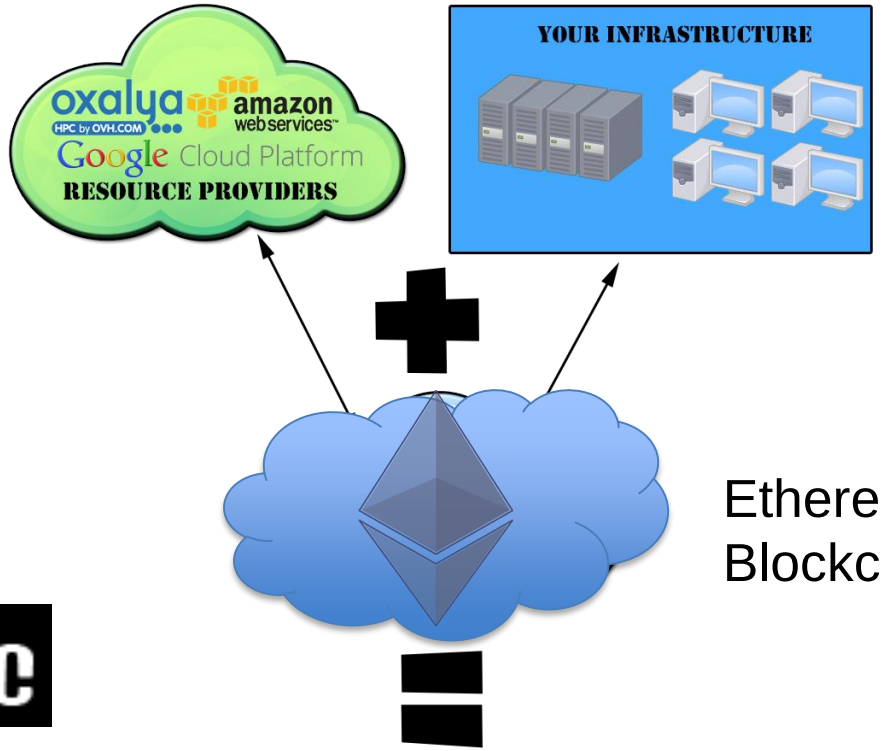
iEx.ec Objective

- Provides Blockchain-based Distributed Applications access to the off-chain computing resources they need:
  - Computing resources (CPU, GPU, storage)
  - Data access (remote storage)
  - Applications (compute and/or data-intensive)
  - Services (deployed as containers)

Global Market for Computing Resources



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Low cost, Secure, on Demand and Fully Distributed Cloud

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Towards Distributed Cloud Computing

- Benefits of Decentralizing Data-Centers.
  - Better energy efficiency
  - Data closer to the user
- Example of next-gen Data-centers

a) Rutgers
b) Stimergy
c) Qarnot

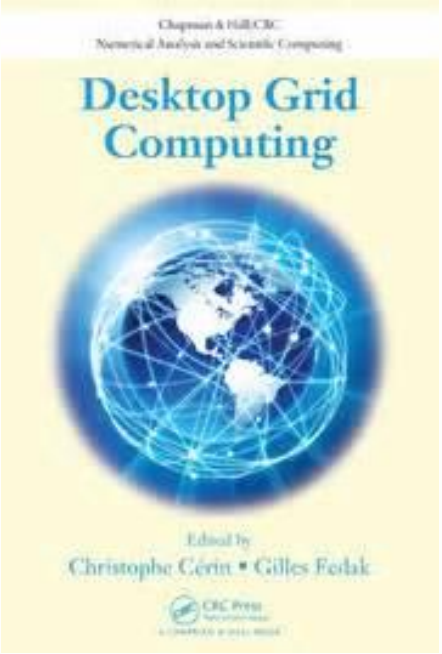
- Fog/Edge Computing

  5G network -- In-network storage and processing

Origin of the Technology : Desktop Grid Computing

Using Idle PCs on the Internet to Execute Parallel Applications :

- Mature technology
- Advanced features: security, virtualization, QoS
- Many applications : Finance, Bio-medical, Chemistry, High Energy Physics etc…
- European Desktop Grid Infrastructure
  - http://desktopgridfederation.org



Book on Desktop Grid Computin. Ed. C. Cérin & G. Fedak, CRC/Chapman and all

Aka Volunteer Computing

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Building Distributed Cloud

Since 1999

2000 — 2001: **MPICH-V**
- Parallel computing
- N-faults resilience

2003 — 2008: **BitDew**
- Large Scale Data Management

2010 — 2012: **SpeQuloS**
- QoS for Best-effort infrastructure

2001: **XtremWeb**
- 1st Internet P2P Global Computing Platform
- Bag-of Task Application
- Multi-users & multi-applications

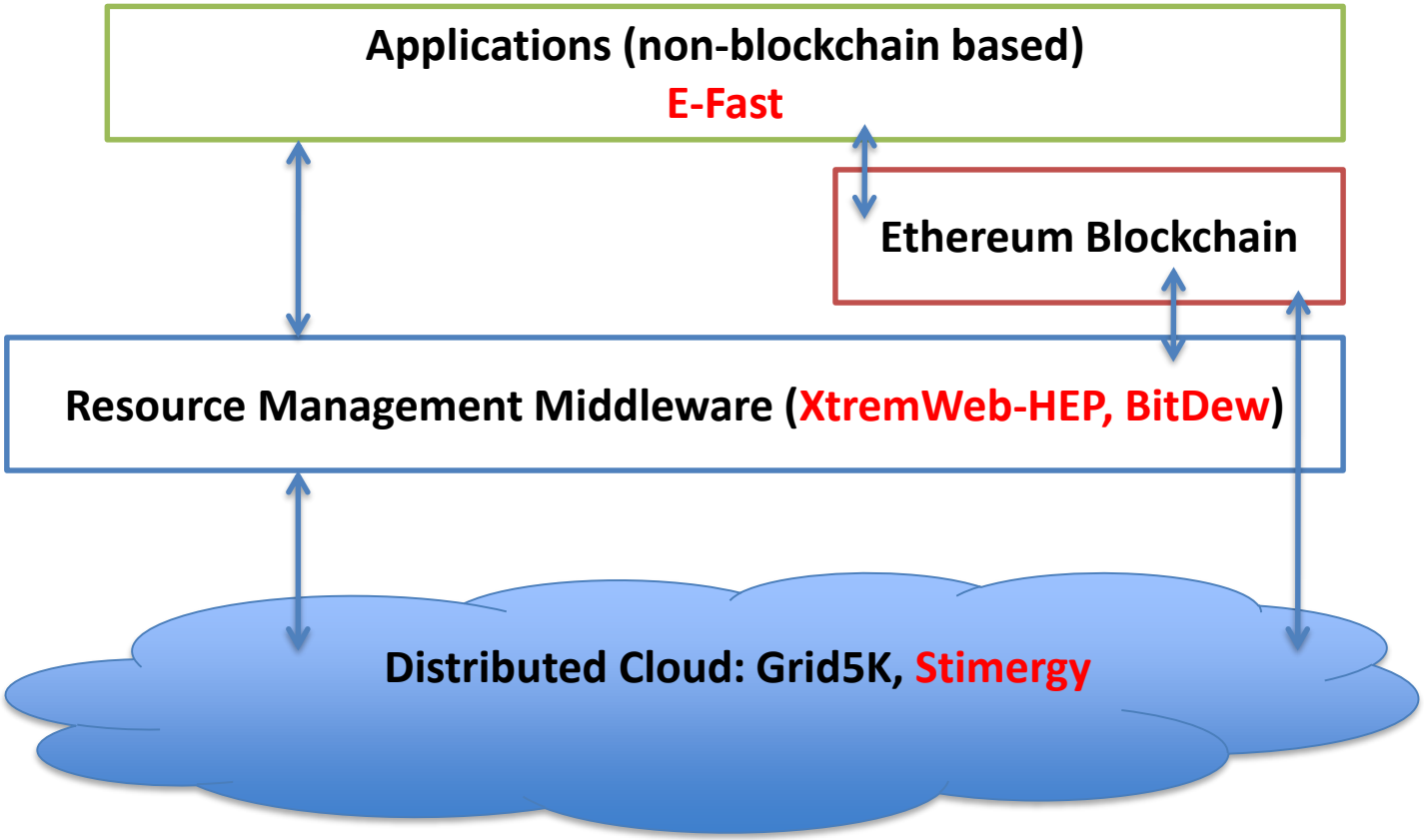
2008: **XtremWeb-HEP**
- Grid & Cloud
- Highly secure
- Virtualization
- Hybrid public/private Infrastructure

2012: **MapReduce**
- Big Data
- 1st Implementation of MapReduce for Internet Computing

Tens of users/applications: Finance, HEP, biomedical research…

>1M€ EU FP7, ANR funding, ≈100 papers published

iEx.ec Experiments



Resource Management on the Blockchain

Matchmaking
Task/Computing resources

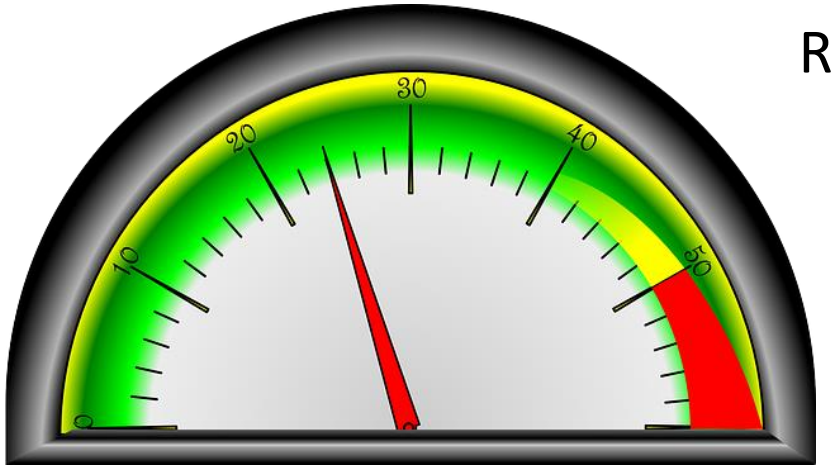
Market Management
Framework

Verified File transfer

Resource Ontology

Result certification

Resource Provisioning



Multi –Criteria
Scheduling

Resource Publication

E-FAST : E-Services Framework for Knowledge-bAsed Decision SupporT in Finance

Service Oriented Platform:

Integrated, advanced tools to analyze financial market data, high-level services that automatically react to market changes and propose investment alternatives

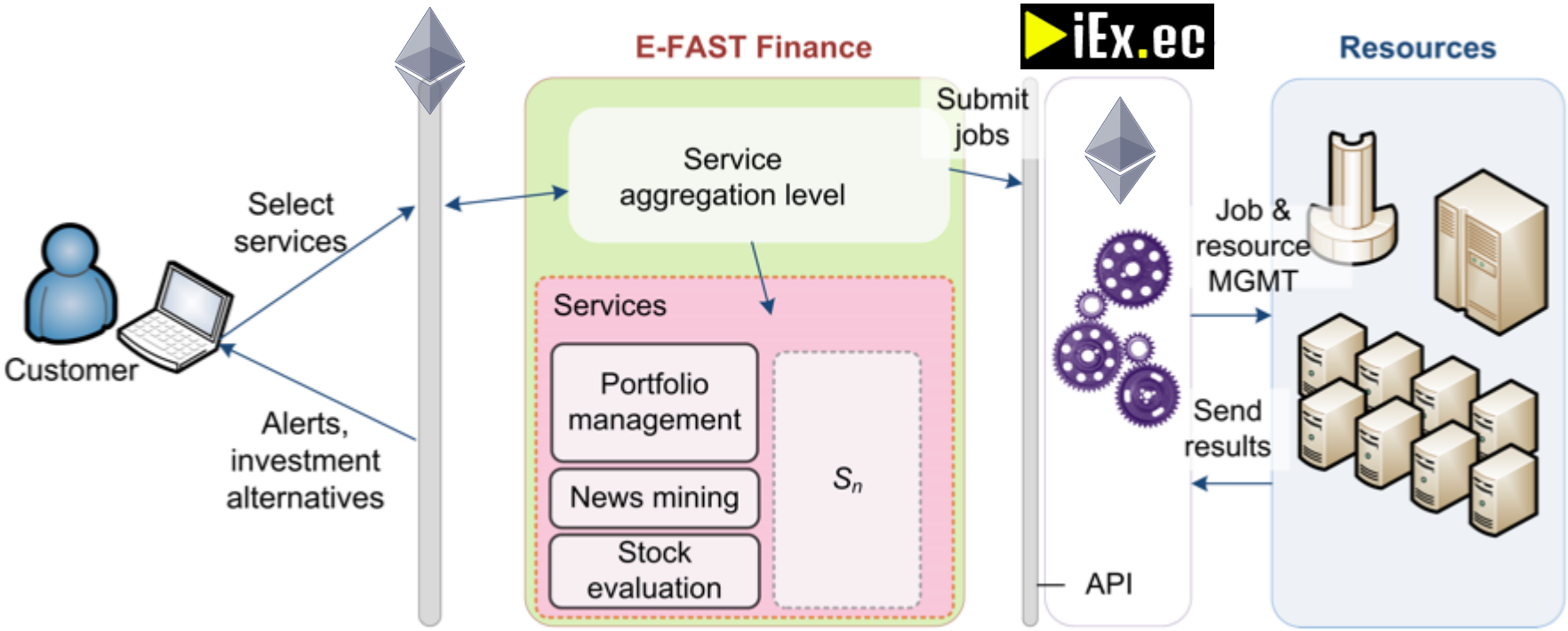
Data and Computing-Intensive Methods:

Text-mining, Neural Networks and Genetic Algorithms, enhanced by applying relevant findings from the efficient-market theory study.

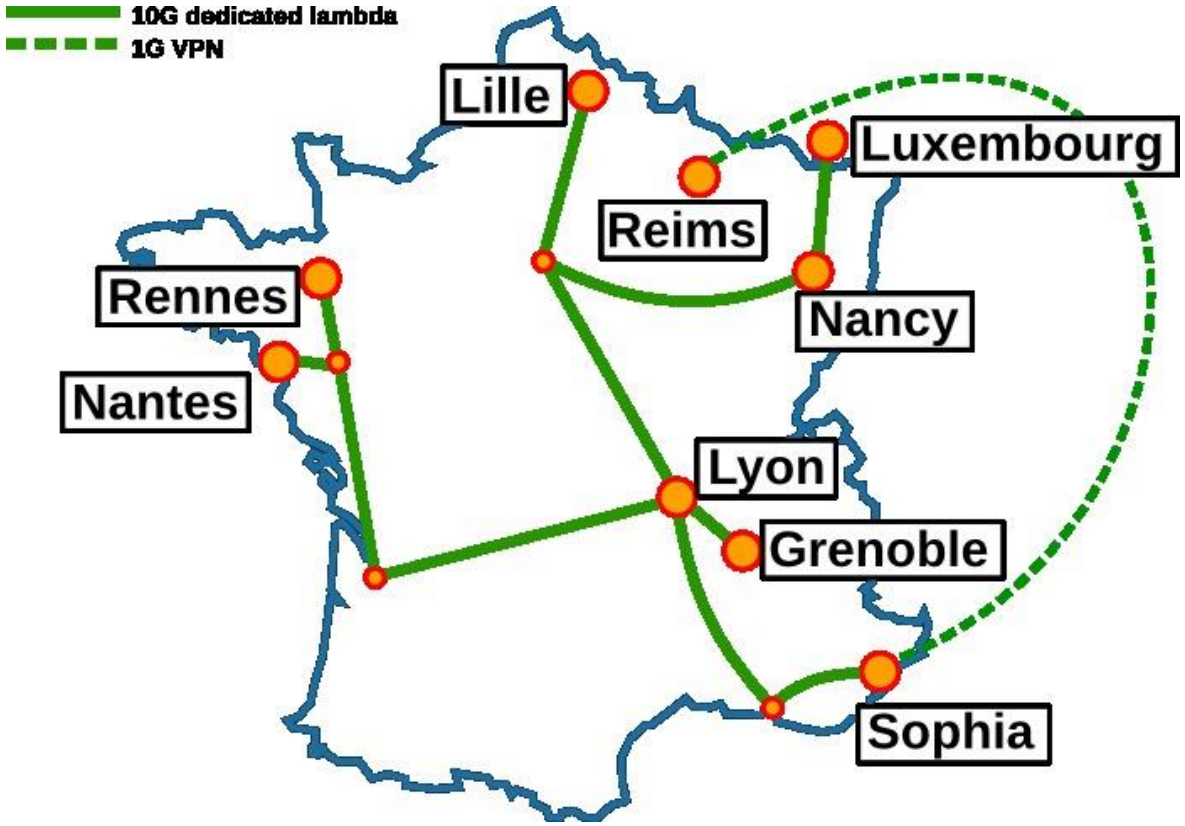
Selling E-FAST using iEx.ec

Customers access E-FAST services which uses iEx.ec for their execution:

Only pay for resources when a service has been sold to a customer



Testbed



Grid5000

French Infrastructure dedicated for research in distributed systems:

- 9 sites, 1000 nodes, 8000 cores
- GPU, Xeon Phi, SSD
- 10Gb network
- Fully reconfigurable (bare metal access)

Use Case

Stimergy

Stimergy: install 10 to 100kW server rooms in buildings and coupling them with their heating system to valorise the heat generated by computers while getting rid of air conditionners

Using Stimergy servers as iEx.ec computing resources

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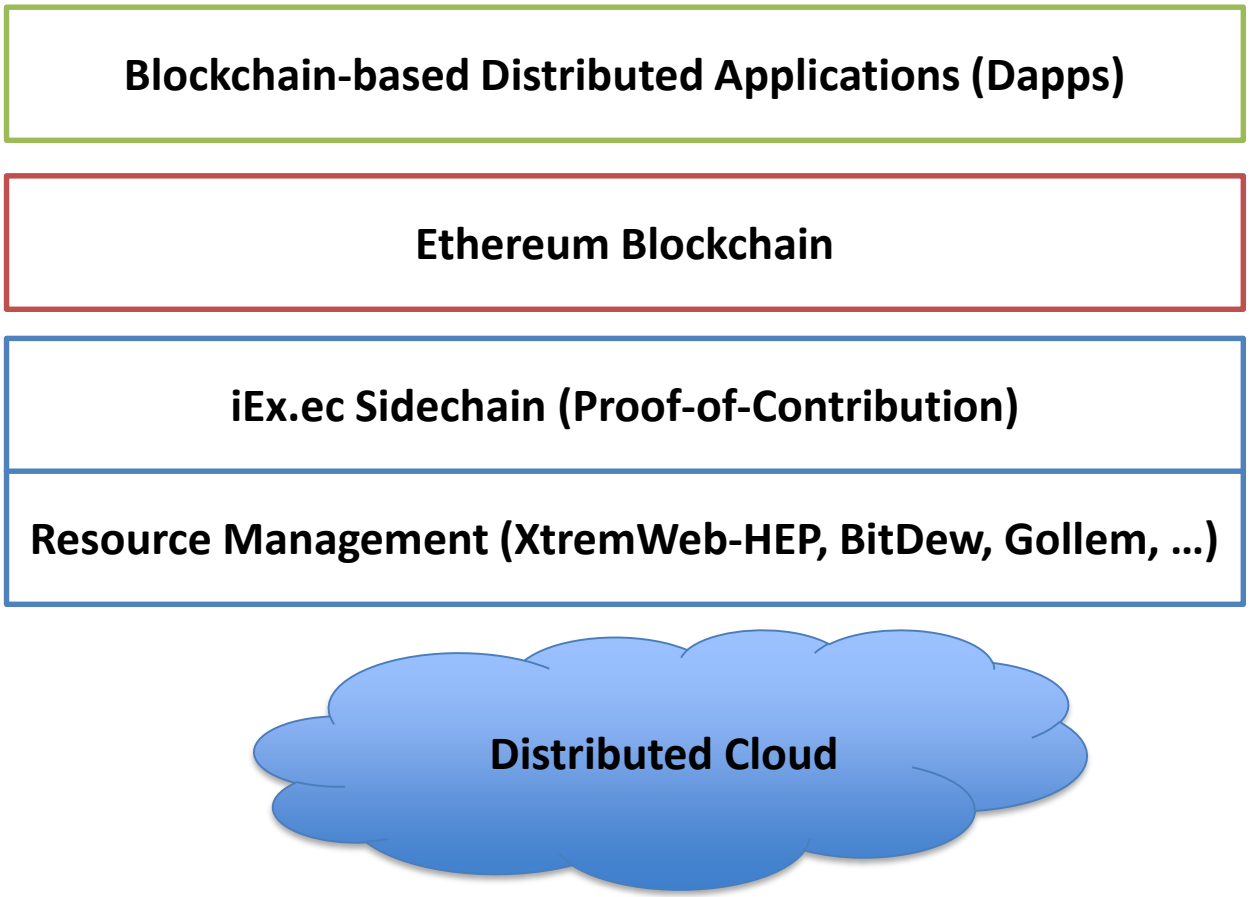
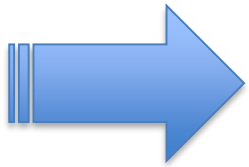
iEx.ec Architecture (Envisioned)

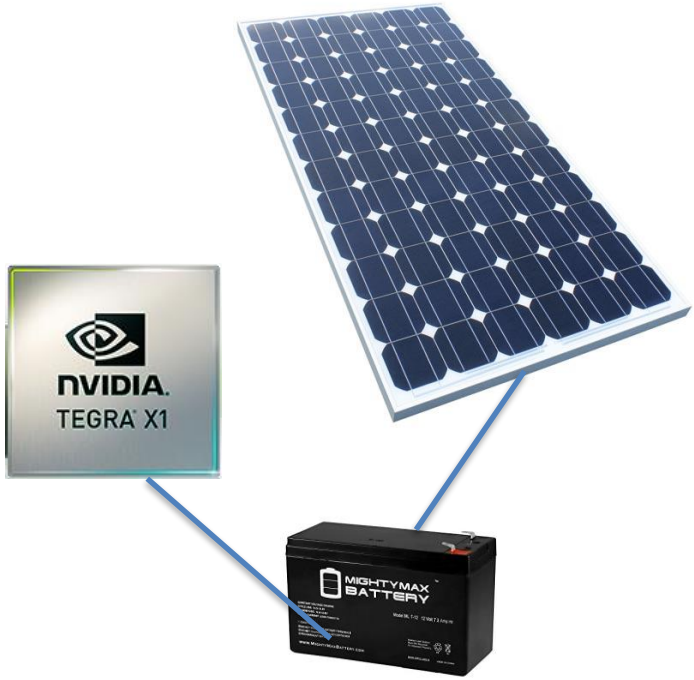


Sidechain for Cloud

- consensus for off-chain resource utilisation (Proof-of-Contribution)
- transient information
- specific workload
- partial consensus

Conclusion





iEx.ec: Greener & Smarter Cloud Computing

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cryptofr slack team, chaintech