A General Purpose Decentralized High Performances Computing platform

HPP

Connect workstations, servers and laptops to form a Big decentralized
High Performance Computing Datacenter

Denver, Colorado, USA

Abstract

HPP (**H**igh **P**erformance Computing **P**latform) is a Distributed infrastructure for Heigh Performance Computing that can carry general purpose computing tasks on heterogeneous devices hosted by large number of distributed nodes considered as Smart properties, Nodes can join and leave the network without affecting the overall Network performance. A node (NODE) can sign a smart contract to process computation on behalf of a tasks provider (PROVIDER) and earn fees paid in HPP (High Performance Computing Platform Coin) upon completion of the contract terms.

Introduction

The main motivation behind this work comes from the increased need of computing power in the academic research centers, academic institutions in most countries cannot afford to have their own HPC (High Performance Computing) infrastructure[3] nor the high cost of HPC cloud service providers. Hence the idea to connect all universities workstations, servers and even laptops and form a big decentralized datacenter The idea is indeed very interesting, and very promising, but a lot of problems should be addressed before we can come up with a scalable and distributed platform for general purpose high performances computing, problems that can be perceived from two different perspectives : economic and technical.

Economic perspective

Computing power scarcity: The economic problem emerges because our computing power needs are greater than our ability to produce this computing power. HPP solve this problem using the concept "Give and Take". a research center in Denver can Give a part of its computing power from 06 PM MST to 08 AM MST and earn HPP coins and use them to Take control of higher computing power from 08 AM MST to 06 PM MST.

Technical perspective

Distributivity

The block chain technology is highly distributed by design, NODES form a peer to peer network [4], communication is implemented in RPC[5].

Anonymity

HPP is built on top of bitcoin daemon[6], a NODE can activate Tor to benefit from high anonymity[7], a NODE can also anonymize the earned coins using the Zerocoin protocol [8].

Security

Node security is ensured through virtualization [9], PROVIDER data security is ensured by encrypting sensitive data and Virtual Host lifecycle control.

Scalability

Nodes automatic deployment, node migration, PROVIDER's data replication.

General Purpose Computing Platform

use of open standards like : Xen virtualization, OpenSSH, OpenCL [10] and OpenMP [11].

Availability

Proof of Uptime and resources availability are checked permanently by the block chain

Trust

Smart Contracts and Micro-payment channels [12]

Masternode

For high compute-intensive tasks the task provider cannot handle the increased workload due to high network communication traffic, large amounts of working-memory demand and high cpu usage. in this case the task provider can delegate task's negotiation and coordination to a Full Masternode.

Lite Masternode (LMN) Minimum requirements

Property	Value
Collateral	1000 HPP in wallet at least
CPUs	4 cores
RAM	8 GB Memory
Storage	100 Gb
Reward	25.64% of the block reward: 20 HPP per block up to block 262500. From block 262501 to 525000 10 HPP per block.

Description : The main role of LMN is to verify zerocoin transactions, after LMN release, mining pools and solo miners will no longer verify zerocoin transactions, they will spend less hash power. LMN ensure the blockchain security and protect the HPP network from sybil attack, LMN recieve 25.64% of the block reward. LMN Cannot Earn additional HPP by carrying Teaks scheduling and negotiation and results verification.

Full Masternode (FMN) Minimum requirements

Property	Value
Collateral	5000 HPP in wallet at least
Network connectivity	200 MB/s network connectivity
CPUs	24 cores
RAM	128 GB Memory
GPU Accelerator	High End GPU (Nvidia Tesla or AMD FirePro)
Storage	1 TB SSD
Reward	FMN makes the same profit as 5 LMN plus 3% of the overall scheduled task fees.

A Full Masternode can earn additional HPP coins on a time basis by carrying negotiation, coordination and results verification on behalf of a task provider. The computation task price is negotiated between the Tasks provider and the Worker nodes based on the Extended Contract Net protocol [13]

Versions Roadmap

The live version of the project Roadmap is periodically updated here

https://trello.com/b/w4CnFCdV/hppcoin

Version 1.0.0-Beta

HPP Coin and built in miner

Zerocoin protocol

GPU Miner Cuda

GPU Miner OpenCL

Mining Pool (http://pool.hppcoin.com)

Block Explorer (http://explorer.hppcoin.com)

Version 1.0.1

Android Wallet

Lite Masternode

Version 1.1.0

OpenSSH support

Host Virtualization

Implement the algorithm to handle Mutexes, barriers, and locks in the HPP platform

Version 1.2.0

iOS Wallet

Dedicated Host Sharing

Virtual Host Sharing

Support for HPC on multiple independent Nodes (suitable for parallel tasks thatcan be split into multiple i ndependent tasks without the need for coordination amongnodes)

Version 1.3.0

Distributed OpenCL Platform[15].
Micro payments channels

Full Masternode

Distributed OpenMP Platform.
Support for HPC on multiple coordinating nodes suitable for high parallel computation task that can be split into several subtasks executed on several distributed nodes requiring coordination among nodes

V 2.0.0

General Purpose HPC Platform
Support for automatic deployment over multiple distributed nodes[16]

HPP Coin specifications

Property	Value
Premine	0 blocks (No Premine)
Ico	No ICO
Block reward	78 HPP
Coin base maturity	120 blocks
Founders and investors reward	8 HPP per block for the first 2 years (70 HPP goes to the block miner and 8 HPP for founders and investors) and 0 HPP after block 262500.
Start time	8:50 AM Wednesday, November 22, 2017(MST)
Total Supply	78 Millions HPP
Symbole	HPP ('eɪtʃ- 'piː- 'piː)
Halving rate	Every 262500 blocks approximately every 2years
Block Time	4 minutes
Hashing Algorithm	LYRA2H
Transactions validation	PoW

Conclusion

HPP is not just a crypto-coin based on bitcoin[14] but an open source distributed platform for general purpose High Performances Computing, every entity that own computing power, ranging from individuals with a single laptop to companies and institutions that own big datacenter, can rent it's computing power and earn HPP coins that can be redeemed anytime at HPP platform to acquire more computing power or can be traded in cryptocurrencies Markets.

References

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- Bitcoin Smart Contracts https://en.bitcoin.it/wiki/Contract
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- Bitcoin white paper : https://bitcoin.org/bitcoin.pdf
- RPC https://en.wikipedia.org/wiki/Remote_procedure_call
- Bitcoin Developer Guide, https://bitcoin.org/en/developer-guide
- Tor https://en.bitcoin.it/wiki/Tor
- Zerocoin zerocoin.org/media/pdf/ZerocoinOakland.pdf
- https://link.springer.com/chapter/10.1007/978-3-540-78474-6_25
- OpenCL https://www.khronos.org/opencl/
- OpneMP distributed Memory System https://www.cs.rochester.edu/~cding/
- Lightning network https://github.com/lightningnetwork/lnd
- Extended Contract Net Protocol https://link.springer.com/chapter/10.1007/978-3-319-04735-5_6
- Bitcoin Developer Guide, https://bitcoin.org/en/developer-guide
- Distributed OpenCL https://www.osti.gov/scitech/biblio/1295154
- SmartFrog http://www.hpl.hp.com/research/smartfrog/papers/GridDeployment-ICNS06.pdf

HPP
HIGH PERFORMANCES COMPUTING