Towards Distributed SLA Management with Smart Contracts and Blockchain

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The ugly truth - Few large providers dominate the market
The ugly truth - Few large providers dominate the market

Consequences - Price, QoS and vendor lock-in
-The ugly truth - Few large providers dominate the market

-Consequences - Price, QoS and vendor lock-in

-Solution? - Trust!!
Blockchain-based Cloud
Solution

- Blockchain-based Cloud
- Public Blockchain - Prosumers
- Blockchain-based Cloud
- Public Blockchain - Prosumers
- Private Blockchain - Intermediaries
Blockchain-based Clouds

Multi-Cloud/Fog

Side-Chain

Cloud/Edge Provider 1
Cloud/Edge Provider 2

Nodes
Distributed Storage

P2P Network

Transaction Network

MarketPlace
App Pool

Computation Verification

Transaction Manager

Smart Contracts

Reputation System

Oracle

Blockchain

Application Providers
Consumers

Overview

### Comparison Table

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<th></th>
<th>Golem</th>
<th>iExec</th>
<th>SONM</th>
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<tr>
<td>Billing model</td>
<td>Pay-per-task</td>
<td>Pay-per-task</td>
<td>Pay-per-usage (time)</td>
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<tr>
<td>Cloud model</td>
<td>SaaS</td>
<td>IaaS, PaaS, SaaS</td>
<td>IaaS, PaaS</td>
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<td>Communication</td>
<td>Whisper</td>
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<td>Whisper</td>
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<td>Computation platform</td>
<td>Own solution</td>
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<td>DAT</td>
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<td>BtSync</td>
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<tr>
<td>GPU support</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Memory guard</td>
<td>✓</td>
<td>✓</td>
<td>✗</td>
</tr>
<tr>
<td>Open source</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>QoS definition</td>
<td>✗</td>
<td>✓</td>
<td>✗</td>
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<td>Reputation system</td>
<td>Own solution</td>
<td>Own solution</td>
<td>Own solution</td>
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<td>Sandboxing</td>
<td>Docker, VMs</td>
<td>Docker, VMs</td>
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<td>Service composition</td>
<td>✗</td>
<td>✗</td>
<td>✗</td>
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<td>Smart contract QoS</td>
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<td>✗</td>
<td>✗</td>
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<td>Transaction network</td>
<td>Ethereum</td>
<td>Ethereum</td>
<td>Ethereum/side chain</td>
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<tr>
<td>Verification</td>
<td>Log, correctness, redundant/high stakes</td>
<td>Redundant/high stakes</td>
<td>Planned</td>
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Rafael Brundo Uriarte
Discuss the main challenges and advantages of blockchain in the domain
Contributions

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- Propose an architecture for smart contract definition and enforcement
Contributions

- Discuss the main challenges and advantages of blockchain in the domain
- Propose an architecture for smart contract definition and enforcement
- Show the first steps of the initial implementation
From SLA to Smart Contracts

1. Consumer
   - Request
   - Offer
2. Provider
   - Static Verification
3. Matchmaking & Negotiation
4. Agreement
   - Smart Contract Transformation
   - Decentralised Multi-Cloud
   - Blockchain
   - Results
   - Oracle
   - Monitoring Information
Dynamic SLAs

- Base: 2 VMs
- Ruby: 9 VMs, RT 0-40 ms
- Diamond: 9 VMs, RT 0-10 ms

Arrows indicate the direction of consumer's and provider's requests.
Ethereum
Initial Implementation

- Ethereum
- Solidity (Truffle)
Initial Implementation

- Ethereum
- Solidity (Truffle)
- SLAC Framework
Proof of Contribution

- Incentives
Proof of Contribution

- Incentives

- Stakes
Proof of Contribution

- Incentives
- Stakes
- Reputation
Proof of Contribution

- Incentives
- Stakes
- Reputation
- Computation Verification
Proof of Contribution

- Log verification - Replaced
Proof of Contribution

- Log verification - Replaced

- Correctness checking asymmetrically verifiable problems - Specific cases
Proof of Contribution

- Log verification - Replaced
- Correctness checking asymmetrically verifiable problems - Specific cases
- Redundant Computation
Challenges

- Transparency (privacy!?)
Challenges

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- Consensus (proof of contribution)
Challenges

- Transparency (privacy!?)
- Consensus (proof of contribution)
- Decentralised algorithms
Challenges

- Transparency (privacy!?)
- Consensus (proof of contribution)
- Decentralised algorithms
- Actual implementation of the whole framework
Final Remarks

- Trust and immutability
Final Remarks

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- Smart contracts automatisation
Final Remarks

- Trust and immutability
- Smart contracts automatisation
- Reshape the cloud market!
Thank you!

Questions?

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