Developer cost comparison with AWS vs Storecoin p2p cloud computing platform

A comparison of approximately what it costs for developers to host their apps on AWS vs the same on Storecoin Platform

v0.1

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App scenarios

For the sake* of cost modeling we used the CPU, memory, bandwidth, and storage used by a single instance of the app. We then assumed a *throughput* to compute the total cost of running the app.

App scenario #	CPU usage to run the app (in ms)	Memory required to run the app (in MB)	Data produced by the app per instance (in bytes)	Total memory required to run 5000 instances of app per second (in GB)	Total storage required to run 5000 instances of app per second (in TB)
A1 (tiny app producing tiny data)	20	32	512	3.125	81
A2 (moderate app producing moderate data)	500	128	32K	313	5,054
A3 (large app)	1000	128	256K	625	40,366
A4 (small runtime, large data)	50	512	384K	125	60,549
A5 (bigger runtime, large data)	1000	512	512K	2500	80,732

* See https://docs.google.com/spreadsheets/d/1WMvGgc8s3gBp1-4QehCVosyjkwZVmhiYIpCxhJvF3KU/edit?ts=5c812cff#gid=769994762 for data sources.

Approximate cost to run the apps on AWS

The cost estimates* are for based on renting EC2, ELB, Firewall, and either EBS or S3 storage. Other costs like devops and any other services that the app may require are ignored. Standard DDoS protection assumed.

Scenario ID	Annual total cost with EBS storage ($)	Annual total cost with S3 storage ($)	Cost per transaction in $ (With EBS)	Cost per transaction in $ (With S3)
A1	$129,421	$30,605	0.00000082	0.00000019
A2	$7,642,208	$1,456,317	0.000048	0.0000092
A3	$60,908,075	$11,499,993	0.000386	0.0000729
A4	$91,319,096	$17,206,973	0.000579	0.000109
A5	$121,870,111	$23,053,947	0.00077	0.000146

* See https://docs.google.com/spreadsheets/d/1WMvGgc8s3gBp1-4QehCVosyjkwZVmhiYIpCxhJvF3KU/edit?ts=5c812cff#gid=769994762 for details.

Approximate cost for Storecoin dWorkers

In Storecoin Platform, dWorkers bear the same costs*. There is no upfront cost to developers. dWorkers are compensated with payments in *datacoins*.

Scenario ID	Total cost to individual Validators ($)	Total cost to individual Messagenodes with EBS storage ($)	Total cost to individual Messagenodes with S3 storage ($)		
A1	$16,688	$25,658	$23,933		
A2	$16,819	$211,139	$98,669		
A3	$17,549	$1,527,323	$628,995		
A4	$17,855	$2,279,600	$932,107		
A5	$18,472	$3,031,877	$1,235,220		

* See https://docs.google.com/spreadsheets/d/1WMvGgc8s3gBp1-4QehCVosyjkwZVmhiYIpCxhJvF3KU/edit?ts=5c812cff#gid=769994762 for details.

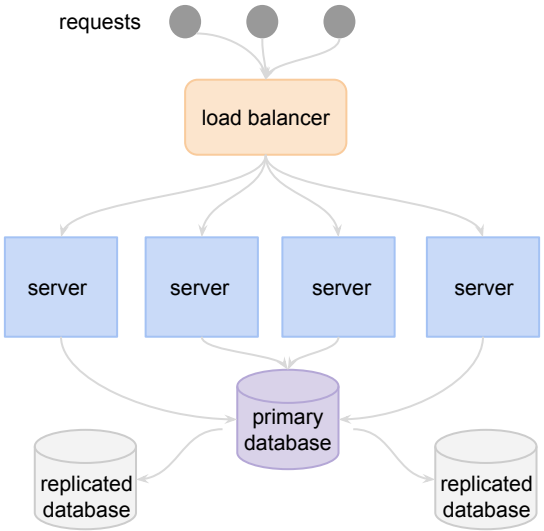
Cost comparison between an app on AWS vs. tApp on Storecoin

Cost of decentralization

Decentralizing app data has its costs compared to centralized systems. The cost is incurred for runtime execution, bandwidth, and storage.

Example:

Assume an app that requires 256MB of memory to run. An instance of the app takes 1 second to run to its completion. It produces 1MB of data upon execution, which is saved in a database. For resilience, 3 copies of data are saved in 3 different zones. The infrastructure is required to support concurrent execution of 1000 app instances.



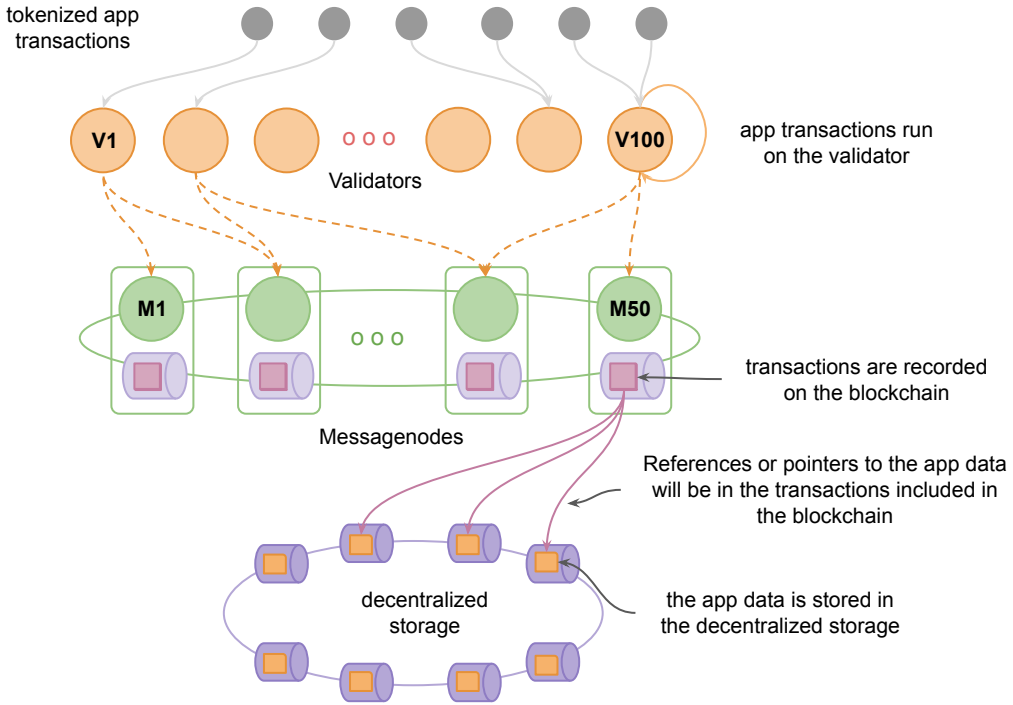
Typical architecture* for a centralized deployment

- To support a concurrency of 1000, a runtime with at least **256GB of RAM** is required. The required RAM may be made available through a cluster of servers.
- For simplicity we assumed an execution time of 1 second per request, so the effective **throughput is 1000**.
-Each request produces 3MB of data in the database — 1MB in the primary database and 1MB each in the replicated databases.
- In a day, a total of 3 x 1MB x 1000 x 60 x 60 x 24 = **~272 TB of data** is generated by the app. In a **year, ~99 PB** of data is produced.

* For determining the cost of decentralization, typical components, like caching, etc., are ignored.

Cost of decentralization

Running the app transactions produces settlement transactions as their result. This is the cost overhead due to decentralization.



App deployment on Storecoin Platform

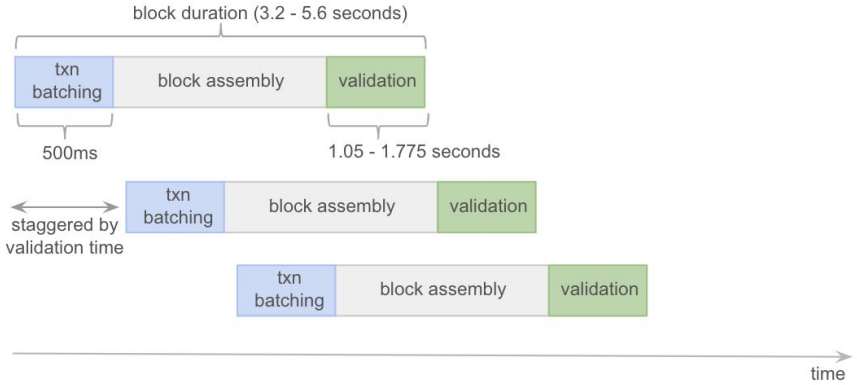
Assumptions:

- Number of validators: **100**
- Number of Messagenodes: **50**
- 256GB of total memory is provided by the Validators. Each validator is required to supply at least **2.56GB** to the shared memory pool.
- App transaction execution produces a settlement transaction as its result. This settlement transaction contains the proof* of execution and other details. The settlement transaction has a size of **500 bytes** and the hash of this transaction is included in the finalized block.
- In a day, the overhead due to creating the settlement transactions is 1000 x 60 x 60 x 24 x 500 = **43.2GB**. These transactions are stored in the decentralized storage, so the effective **yearly** storage overhead is 43.2 x 3 x 365 = **~16TB**.
- The settlement transactions will result in additional blocks created. From the settlement economic model, the storage cost is 19 TB for ~1000 TPS.

* https://link.springer.com/chapter/10.1007/978-3-642-14215-4_2

Cost of decentralization — perceived delay

The app instance returns the response only after the transaction is included in the block. This increases the perceived delay in the user interface of the app.



- From the time a tokenized app transaction is submitted to getting the response of its execution, a delay of 3.2 - 5.6 seconds is possible. This delay is due to the BlockFin consensus algorithm, which includes the transaction submitted in the next empty block and then validates it.
- Pipelining and parallelization in the BlockFin consensus algorithm results in the continuous production of new blocks, but the above delay exists from the point of view of the sender.
- This delay is noticeable in the UI, if the user is waiting for the response in the app, but matters less, if the transaction is submitted via the APIs. In the latter case when the block is finalized, a bulk response can be generated for all the transactions included in the block, which averages the response time.

Cost of decentralization — summary (based on the example)

App data decentralization has storage and response overheads. This cost is due to how the public blockchains work — there is no centralized entity to trust the data, so it must be baked into the protocol.

Centralized app deployment	Decentralized app deployment on Storecoin p2p cloud	Comments
The runtime (CPU and memory) is the responsibility of the app developer. A cluster of servers with at least **256GB of memory** is required to run the app for a **concurrency of 1000**.	The runtime (CPU and memory) is the responsibility of dWorkers. Validators collectively provide **256GB of memory** required to run the app for a throughput of **1000 TPS**.	The runtime requirements are exactly the same. In the case of Storecoin p2p cloud, the required memory pool is shared among the Validators, so each validator's cost is a fraction of the total cost of the memory required.
In a year, approximately **99 PB** of data is generated by the app. This includes 3 copies of the data for resilience.	**99 PB** of data is produced in this deployment also, since the data is produced by the app. Messagenodes collectively host the app data.	The app data storage capacity required is exactly the same. The cost of the decentralized storage network is shared among all the Messagenodes, so each node is responsible for a fraction of the total storage cost.

Cost of decentralization — summary (continued)

Centralized app deployment	Decentralized app deployment on Storecoin p2p cloud	Comments
The compute and storage are hosted on a **trusted, private** infrastructure.	The compute and storage are hosted on an **untrusted, public** blockchain. Because of this, an additional cost is incurred per app transaction to include it in the blockchain. This cost is 500 bytes per app transaction, totalling **~16TB** per year.	This **"decentralization storage overhead"** is applicable only to Storecoin p2p cloud.
The **runtime is a trusted, private infrastructure**, so users can be confident that the app data is persisted correctly in the app.	The **runtime is an untrusted, public blockchain**, so trust must be derived from a BFT consensus algorithm. The cost of this overhead is **~19TB** per year. This cost comes from all the blocks produced and maintained to keep track of the app transactions.	This **"decentralization trust overhead"** is applicable only to Storecoin p2p cloud.

Cost of decentralization — summary (continued)

Centralized app deployment	Decentralized app deployment on Storecoin p2p cloud	Comments
The app response time is likely from a **few hundred milliseconds to a couple of seconds,** depending on the network latency and load on the servers and databases.	Because the **runtime is an untrusted, public blockchain**, the trust must be derived from a BFT consensus algorithm. This introduces a **delay of 3.2 - 5.6 seconds**, depending on the network latency. This is the time it takes to build and finalize the blocks in the Storecoin p2p cloud.	This **"decentralization trust perceived delay"** is applicable only to Storecoin p2p cloud.