



Establishing a Framework for Collators on System Parachains



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Version History

Revision	Date	Details
0.1	16-Jan-2023	Initiation.
1.0	20-Jan-2023	First draft.
1.1	22-Jan-2023	Submitted for wider review.
1.2	25-Jan-2023	Updated the methodology for the selection and determination of total number of Collators per Joe's and Pmensik's feedback.
1.3	28-Jan-2023	Included details on transitioning from current to proposed based on feedback from Mile.
1.4	4-Feb-2023	Published for public comment.
1.5	7-Feb-2023	Request for further details on curators added *
1.6	23-Feb-2023	Added a fixed amount of 10 KSM for administrative and 10% for slippage, EMA was adjusted along with all other calculations. On-chain submission issued.

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EMA7 \$41.78/KSM
Proposer Paradox - Address

Requesting 1,873.69 KSM

1.0 Summary

A System Parachain (S.C.) is defined as any Parachain which attained its lease via governance. This proposal aims to establish a framework for Collators on System Parachains to minimise censorship, maintain liveliness and incentivise efficient performance.

It attempts to achieve this by suggesting parameters for the selection, incentivisation and the ideal number of Collators on System Parachains. It is also anticipated that this framework would form a standard that would aid future System Parachains as they are deployed.

As a medium term solution, **1,873.69 KSM** is requested to fund a **bounty** to incentivise Collators on the **Statemine** network for **six (6) months**. This would be used as a pilot test and re-evaluated before further funding is provided.

2.0 Problem Statement

A diverse collator set is desired to ensure liveliness and censorship resistance for the networks that they support. This is particularly important for System Parachains as their services can, at the most critical level, be foundational to other Parachains or networks. Poor performance from Collators can lead to longer block times and ultimately a less than ideal user-experience.

At present, Collators on System Parachains are provided with minimal rewards for block production and little other incentives in terms of transaction fees. This reduces incentives for Collators to act in a favourable manner and they may also be inclined to under-resourcing their hosts to save costs. This may work under low-load conditions but falter under higher loads.

A framework is necessary to determine how System Collators are **selected** and **incentivised** and to determine the **ideal number** of Collators to achieve the goals of liveliness and censorship resistance.

3.0 Background

A System Parachain is defined as one which has attained its lease by way of governance. It is anticipated that these Parachains would attain such leases by providing a common good to the respective networks that they serve. The list of active System Parachains are:

Table 1: System Parachains by Network

	Network	Parachain Name	Permission-less Entry
1	Kusama	Statemine	Yes
2	Kusama	Encointer network	No
3	Kusama	BridgeHub	No
4	Polkadot	Statemint	Yes
5	Polkadot	Collectives	No

Statemine and Statemint are the only System Parachains to have on-boarded community collators in a permission-less manner. These chains were initially deployed with four (4) Invulnerable Collators provided by the chain's development team (Parity).

With later governance motions, the number of Invulnerable Collators was reduced from four (4) to two (2) and new Collators were allowed to join in a permission-less manner. Permission-less Collators can register as Collator candidates by supplying a deposit of 1,000 DOT or 50 KSM and are on-boarded on a first-come, first-serve basis.

Table 2: Collators tally by network

Network	Invulnerables	Permission-less
Statemine	2	12
Statemint	2	6

Collators on the Statemine and Statemint networks receive rewards based on transaction fees in the native token of the chain. At present these fees are substantially low and specific to Statemine and Statemint this revenue stream becomes jeopardised with each asset that becomes 'sufficient' i.e. pays no transfer fees.

The [primary discussion](#) for developing an economic model for System Collators was held on the Polkadot Forum. Solutions were proposed around the idea of appropriating portions of

inflation to fund System Collators. It was also suggested that remuneration could be provided to System Collators by the Treasury as an interim solution.

The discussion does not identify a specific amount for payment but indicates that it should be relatively low, that it should be relative to the Collator's usage and that rewards should be based on performance.

Additional [discussions were held](#) with collators and validators to establish a baseline cost for operations. Collators were asked to provide their monthly costs for hosting, tooling, maintenance and with availability in mind, provision of a backup host. A summary of the costs are provided in *Table 3* below and are further detailed [here](#).

Table 3: Monthly Operational Costs for Collators

	Average Cost	Minimum Cost	Maximum Cost	Standard Dev.
Monthly Cost	\$311.70	\$207.00	\$505.83	\$86.95

4.0 Proposal

4.1 Selection

The collator set of System Parachains currently comprises Invulnerable Collators and permission-less collators (where applicable). Invulnerable Collators are selected by governance and are at present operated by the developers of the chain. Permission-less Collators, supply a deposit and register as collator candidates on a first-come, first-serve basis.

The proposal suggests the set of Invulnerable Collators should comprise community based collators. They should be inducted as a matter of governance and on the basis of their past-performance. Candidates may propose their intent to be selected with the support of a resume or other supporting information.

The chain should also allow for the inclusion of collators in a permission-less manner. Maintaining existing standards, this would require deposits of **50 KSM** or **1,000 DOT** (as applicable) and inclusion would be based on a first-come, first-serve basis.

4.2 Incentive

Collators should receive funding for provision of their services. Ultimately, this should be provided by the chain in a preferably sustainable manner. Implementation of such a system is a long-term solution. In the medium term, funding for collators can be provided by the respective Treasuries in the form of a bounty. This allows funding to be pre-allocated and independently managed.

Each Permission-less Collator should be rewarded with a **fixed-fiat, token equivalent** disbursement at the onset of each month based on performance factors of the **previous month**.

The leading performance factor for Collators is block production, thus, rewards should be proportional to the ratio of blocks generated to blocks assigned. In the event that the list of Permission-less Collators changes during the month, funds would be issued pro rata.

Any claimable rewards would be voided with the issuance of subsequent month's disbursements. Participants would NOT be compensated for any effects due to price volatility between the times that funds are disbursed and the time that they are claimable.

This system of evaluation and disbursement can be automated by development of appropriate scripts or tools.

4.3 Staking Rewards

As discussed in Section 4.1, adequate token deposits for Permission-less Collators are required to deter sybil attacks. This also introduces a financial loss, or opportunity cost to the Collator who would otherwise be able to use these funds to receive staking rewards.

It is proposed that Permission-less System Collators should **receive staking rewards** based on the chain's average return rate for any given analysis period.

4.4 Fixed-fiat Incentive

As seen in *Table 3* baseline costs differ greatly amongst participants. This is primarily driven by two factors:

1. The ideal specifications for a collator is not established but it is [discussed](#)
2. Costs of different hosting providers or hosting options

The Polkadot client provides a benchmark tool that acts as a reference for validator host performance. In the absence of any tool specific to collators, host machines used for collation should pass all benchmark tests. The specifications of all submissions per the [Validator and Collator cost discussion](#) are deemed fit-for-purpose.

Where submissions were received for co-located solutions, capital costs were distributed over a 24 month period. In the absence of any data that suggests otherwise we are inclined to recommend a rounded average of **US\$300.00/mth** to cover costs for hosting, operations and to maintain a backup server.

4.5 Ideal number of Participants

Barring special use cases, there is no established ideal number of Collators for a particular Parachain. The allocation is arbitrary, and is subjective to the degree of censorship resistance and liveliness resilience that is “deemed acceptable” by its owners. It is however apparent that having a single or few entities entrusted with all Collation activities is not a good thing.

With that said, the ideal number of collators should be determined by each System Parachain with the aforementioned goals in mind. For better alignment to these goals, it is suggested that the number of Invulnerable Collators for a System Parachain exceed the number of permission-less Collators. As it applies to the workload of Statemine and Statemint, it is suggested that each chain should maintain fifteen **(15) Invulnerable** Collators and **five (5) Permission-less** Collators.

Should this proposal be accepted there would be a period of transition in which prospective Collators would submit their intent to be considered as an Invulnerable Collator. Submissions should be made in a public manner preferably in Polkasassembly or on the Polkadot forum.

The decision to include any candidate will be determined by the community with the use of [upcoming extrinsics](#) in public referenda.

5.0 Management

5.1 Support tools

Tooling is required to support efficient and accurate retrieval of data required for payments as detailed in sections [4.2](#) and [4.3](#). This tool should be easy to use and should be able to generate call-data hashes for curator payouts.

5.2 Curator

A Curator is required to ensure the accurate disbursement of funding from the bounty. This entity would be responsible for ensuring the accuracy of data from the tool as referred to in section [5.1](#). Further to this, they would be prepared to issue manual payouts if any technical issues arise with the tool.

A curation team of three (3) individuals utilising a two (2) out of three (3) multi-signature account is suggested. The curators should be technically capable of using the tool as suggested in 5.1 and have a general knowledge of collation/block production from an end-user perspective. Finally, the curators should not be prospective candidates for funding under the bounty.

Curators should be paid a **fee of 5%** to provide an incentive for timely payouts. In the likely case that the tool in section [5.1](#) works as intended, the curators' involvement would be minimal.

6.0 Budget

6.1 Summary

The proposal aims to secure funding for Collators on the **Statemine** network for the period of **six (6) months** as a pilot. Future funding can be evaluated based on the readiness of longer term solutions. In addition to the funding described in sections four (4) and five (5); with the community's approval the proposal seeks to recover funding for **previous month's service** on the Statemine chain.

6.2 Performance based Monthly Incentives

A total of **861.66 KSM** would be allocated for monthly incentives for 20 collators as detailed in section [4.4](#)

Table 4: Monthly Incentives for Collators

	Quantity	Unit
Candidates	20	Nr.
Period (Months)	6	Months
Cost per Period	\$300.00	\$
Total	\$36,000.00	\$
KSM	861.66	KSM

6.3 Staking Rewards

An estimate of **90.00 KSM** is required to reimburse Collators for the loss of staking rewards based on an 18% APY as described in section [4.3](#). This allocation would only be applicable to collators who entered the active set in a permission-less manner.

Table 5: Estimated Staking Rewards Earned by Collators

	Quantity	Unit
Collators	20	Nr.
Bond Size	50	KSM
Sum	1000	KSM
Average Total Monthly Staking Reward	90	KSM

6.4 Tooling

A total of **76.59 KSM** would be attributed to development of a tool to facilitate incentive based payouts and staking rewards as described in sections [4.2](#) and [4.3](#) respectively.

Table 6: One time cost for developing tooling

	Quantity	Unit
Hours	40	hr
Rate	80	\$/hr
Total	\$3,200.00	\$
KSM	76.59	KSM

6.5 Retroactive Payments

The registered date for each candidate was retrieved from a block explorer and used to establish the length of time (in months) each candidate operated. The proposal seeks to attain **613.69 KSM** for retroactive payments up-to the end of March 2023.

Table 7: Retroactive payment for existing collators

	Identity	Registered At	Months	USD	KSM
1	Polkadotters	2022-03-27 19:05:30	12.27	\$3,682.05	88.13
2	ParaNodes	2022-03-29 02:55:54	12.23	\$3,668.78	87.81
3	LuckyFriday	2022-03-31 19:20:12	12.14	\$3,641.94	87.17
4	Iceberg Nodes	2022-11-17 19:08:36	4.44	\$1,332.02	31.88
5	Stake Plus	2022-11-17 19:09:54	4.44	\$1,332.01	31.88
6	BlueFin Tuna	2022-11-17 19:11:42	4.44	\$1,332.00	31.88
7	Mile	2022-11-21 08:34:48	4.32	\$1,296.43	31.03
8	BLD	2022-11-21 09:04:00	4.32	\$1,296.22	31.02
9	ExtraCoin	2022-11-21 11:34:24	4.32	\$1,295.18	31.00
10	Sik	2022-11-17 19:07:36	4.44	\$1,332.03	31.88
11	YoloStatemine	2022-11-21 08:40:00	4.32	\$1,296.39	31.03
12	TurboFlakes	2022-02-10 12:11:24	13.78	\$4,134.92	98.97
	Total			\$25,639.97	613.69

6.6 Total fees including Curator fees

An allocation of 10 KSM is being included as an administrative allocation for curators to draw upon for establishing multi-sigs and any fees or deposits associated. After applying a 5% fee for the Curator and 10% slippage, the total request for funding is **1,873.69 KSM**

Table 8: Summary of requested funds

Section	Title	Total USD	Total KSM
6.2	Monthly Incentives	\$36,000.00	861.66
6.3	Staking Rewards	\$3,760.20	90.00
6.4	Tooling	\$3,200.00	76.59
6.5	Retroactive Payments	\$25,639.97	613.69
	Administrative		10.00
	Curator Fee	\$2,148.01	51.41
	Slippage (10%)		170.34
	Total	\$70,748.18	1,873.69

7.0 Conclusion

As more System Parachains are deployed a framework is necessary to reduce censorship and ensure liveness. It is suggested that each System Parachain should allow for twenty (20) collators, fifteen (15) collators would be assigned by governance after a performance-based assessment. The remaining five (5) would be assigned based on a bond-based election, this requires a deposit of 50 KSM or 1,000 DOT as applicable.

Providing performance based rewards to Collators incentivises them to perform in a manner that supports efficient operations of the chain they support. In the medium-term provisions of such can be disbursed from the Treasury. In the longer term, System Chains should provide incentives without intermediaries.

One long-term option that was presented involves allocating a portion of relay-chain inflation for use as performance based incentives. While feasible, this undertaking puts a strain on relay-chain rewards which are already variable. Another viable option is to scale transaction fees so that the chains can sustain themselves, more so when traffic increases.