✅
Mantle

Executive Summary

This report provides a detailed analysis of transaction fees on the Mantle Network and evaluates its profitability, covering both the revenue side, derived from gas fees, and the cost side, made of transaction fee payments for Data Availability (DA) on Ethereum by Mantle.

Mantle utilizes $MNT for gas fees and has an unorthodox tokenomics structure, with the supply split between the Treasury and Circulating supply at 49.0% and 51.0%, respectively. The network employs a private mempool and supports meta transactions(enabling users to designate a sponsor and decide the percentage of the transaction fees they will cover) and offering two transaction types: the EIP1559 transaction type and the legacy type. With tips users can speed up the processing of the transaction, however the mempool is private. A key parameter, the tokenRatio, adjusts fees by obtaining prices for ETH and MNT from multiple price oracles and calculating their exchange rate (eth_price/mnt_price). Mantle v2 Tectonic limits the value of the current tokenRatio to the interval of the previous tokenRatio to prevent sudden and significant fluctuations in gas prices caused by abrupt changes in the exchange rate.

Mantle v2 Tectonic adopts Mantle DA, powered by EigenLayer's EigenDA technology. Only state root data, along with very limited transaction data, is posted to L1 contracts (l2BlockNumber, l1Blockhash, l1BlockNumber), while the rollup data is posted to Mantle DA. This reduction in L1 data posting contributes to lower fees. With the Tectonic upgrade, both costs and revenue are lowered as a consequence of the reduced L1 portion of the fees. Total profit after converting MNT to ETH: 444.00 ETH.

Impact on our design: Mantle's fee design provides inspiration for a way of introducing a native token for transaction fee payments and managing the exchange rate between ETH and the network's native token, however Mantle rose from the BitDAO community as they migrated from already established token BIT to MNT on a 1:1 ratio. The concept of a private mempool is also intriguing and requires further exploration. Additionally, using our own DA solution before implementing EIP-4844 is worth considering. As Mantle operates as an optimistic rollup, these possibilities need to be thoroughly researched to assess their potential benefits and applicability to our system.

Introduction

Mantle is a a Layer 2 Optimistic rollup built on Ethereum launched on July 17 2023. It uses MNT token as its currency for paying transaction fees for interacting and deploying on the network. It aims for an average block time of 2 seconds and a gas limit of 200,000,000,000 gas.

Goals & Methodology

The main goal of the report is to analyse Mantle data and to determine:

1. Data Availability cost (ETH)

2. Before EIP-4844

3. After EIP-4844

4. Fee movement if it is dynamic

5. Total revenue

6. Economics specifics

This research is performed by obtaining transaction fee data and DA transactions data using Dune Analytics. The Economy and other specifics are acquired by reading official documentation, blogs, and other materials on Mantle network. For profitability calculations we converted daily $MNT earnings to $ETH by using closing price of $MNT in $ETH for the corresponding day.

Results & Discussion

Economics Specifics

Mantle uses $MNT as its utility (fee payment) and governance token. In terms of governance, each $MNT token carries an equal vote weight. As a utility token (after tectonic upgrade) $MNT is utilized natively for gas fees on Mantle Network. Additionally, $MNT tokens can serve as collateral asset for permissioned nodes providing data availability services via Mantle DA. There is no "significant" vesting schedule. Supply is split between Treasury and Circulating 49.0% and 51.0% respectively. Treasury funds are unlocked per proposal basis and spent on incentives, team and other initiatives.

EIP-1559 was not supported in Mantle v1 and is supported in Mantle v2 Tectonic. Sequencer is centralized. **EIP-4844 is not enabled yet and it is a potential implementation so there is no pre and post Dencun changes to analyze.**

Tectonic upgrade specifics are as follows:

- EIP-1559

- Stable block time

- Removal of data transport layer and threshold signature scheme. Tectonic introduced the **op-batcher**, a component that obtains data from the sequencer, performs encoding and compression, sends it to the DA module, and submits data validity information to the L1 contract. Additionally, it introduces the **op-proposer**, which obtains the state root of packed blocks through the sequencer and sends it to the L2OutputOracle contract on L1. More information on the current and past approaches can be found here: Old, New

- MNT will be a native Mantle Network L2 asset, instead of a bridged version of its Ethereum ERC-20 counterpart
- Meta Transactions designed to facilitate the payment of transaction fees on behalf of the users (enabling users to designate a sponsor and decide the percentage of the transaction fees they will cover)
- The transaction mempool is designed to be <u>private</u>

As treasury is allocated a large portion of the supply (49%) we will cover the main expenditures:

- User Incentives - season achievements, quests, and other incentive programs.
- Technology Partner Incentives: incentivizing dApps, infrastructure service providers, and core protocol technology partners
- Core Contributor Team and Advisors
- Other Opportunities: potential opportunities that may arise, such as acquisitions, token swaps, treasury sales, and other deals
- Essentially all spending is voted on, there is no programmatic (automatic) incentives in place.

Transaction Pricing Mechanism Specifics

We will go over transaction fee mechanisms before and after Tectonic upgrade:

Before Tectonic:

$$Fee = l2TransactionExecutionFee + L1RollupFee$$

L2 transaction fee was as follows:

$$l2TransactionExecutionFee = l2TransactionGasUsed \times l2TransactionGasPrice$$

L1 rollup fee was calculated based on gas price on Ethereum, fixed overhead, scalar, and parameters related to size of the transactions:

$$L1RollupFee = (rollupDataGas + overhead) \times L1gasPrice \times scalar$$

Parameter values:

$$Scalar = 10000$$
$$Overhead = 188wei$$

State roots generated on L2 due to transaction execution are published to Ethereum.

Mantle used $MNT as a fee token (ERC-20).

After Tectonic upgrade:

Gas fees in $MNT are enabled (natively) via including tokenRatio parameter. It uses EIP-1559 with the following properties:

- Adjustment rate is the same as in the Ethereum model = 1/8 (12.5%)

- BaseFee is not burned but collected to the [BaseFeeVault](#) contract

- Transactions are sequenced using FIFO method. Priority fee has minimal impact but users can still set it.

$$Fee = l2TransactionExecutionFee + L1RollupFee$$

L2 transaction fee is as follows:

$$l2TransactionExecutionFee = l2TransactionGasPrice \times l2TransactionGasUsed \times tokenRatio$$

l2TransactionGasPrice has two options depending on the transaction type chosen:

- EIP1559 transaction type: l2TransactionGasPrice is affected by the **GasTipCap** parameter, which is a parameter that is issued as a reward to sequencers and can be set to 0 by the user and does not affect the packing of transactions.

- Legacy type: here the gasTip cap default value is 0.1 Gwei. l2TransactionGasPrice is equal to the sum of GasTipCap and BaseFee.

L1 rollup fee is based on Op Stack's specification and is as follows:

$$L1RollupFee = (rollupDataGas + overhead) \times L1gasPrice \times tokenRatio \times scalar$$

Parameter values:

rollupDataGas - size of the transaction as calldata (takes around 85% of L1 gas used) this should lower once EIP-4844 is live on Mantle. It counts the number of zero bytes and non-zero bytes in the transaction data, with each zero byte costing 4 Gas and each non-zero byte costing 16 Gas, thus:

$$rollupDataGas = count\_zero\_bytes(tx\_data) \times 4 + count\_non\_zero\_bytes(tx\_data) \times 16$$

Overhead and scalar are loaded from configuration and not supporting dynamic ranges and are the same as pre-Tectonic: 10000, 188wei, respectively.

Token ratio:

tokenRatio is a parameter adjusting fees in Mantle. By obtaining prices for ETH and MNT from multiple price oracles and calculating their exchange rate **(eth_price/mnt_price)**, Mantle v2 Tectonic limits the value of the current tokenRatio to the interval of the previous tokenRatio to prevent sudden and significant fluctuations in gasPrice caused by abrupt changes in the exchange rate. **We are still waiting for the response from devs on the interval, no response....**

Data Availability

Mantle v2 Tectonic adopts Mantle DA (this is where the reduction of fees comes from) , powered by EigenLayer's EigenDA technology. To quote: **"*Once the standardized solution of EigenDA is ready for mainnet launch, Mantle will migrate its DA component to EigenDA for more efficient data availability. Additionally, Mantle DA allows permissioned nodes to provide data availability services to Mantle network, requiring $MNT staking to ensure network security.*"**

The majority of L2 gas costs (>70%) are incurred as the cost to publish data on L1 Ethereum. With Mantle DA powered by EigenDA technology, only state root data (along with very limited transaction data) is posted to L1 contracts, while the rollup data is posted to Mantle DA.
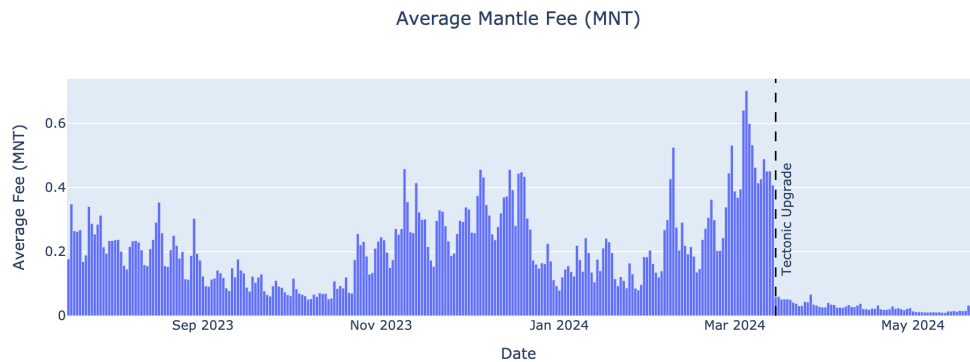
Data Analysis

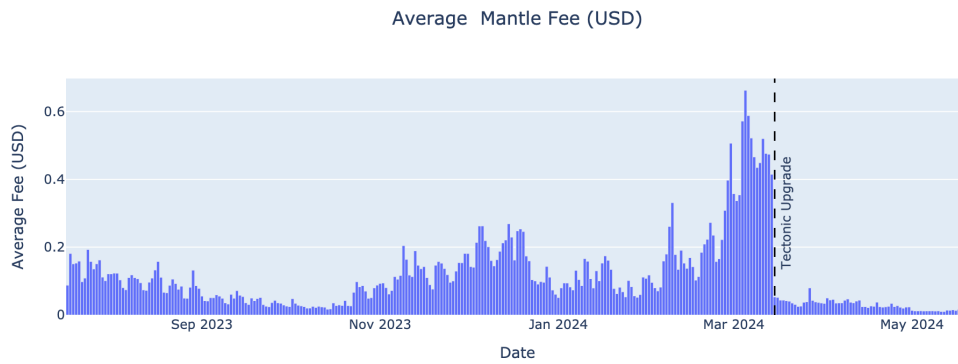## Revenue (Transaction Fees paid by users of Mantle L2 Network)

Average fees on Mantle:

Average L1 and L2 Fee on Mantle (MNT)

Average L1 and L2 Fee on Mantle (USD)
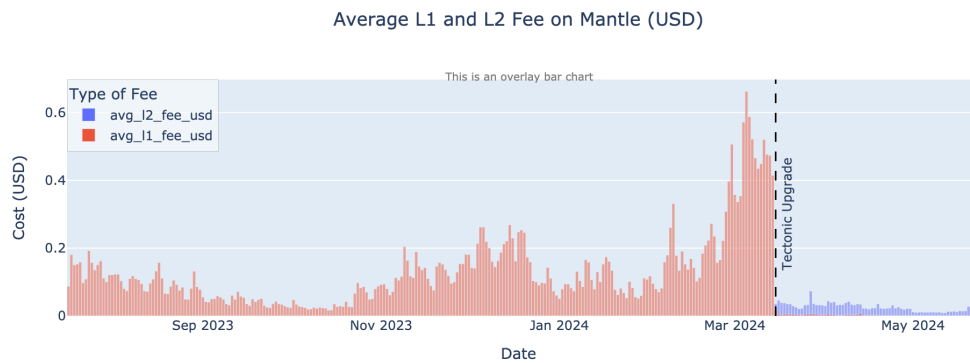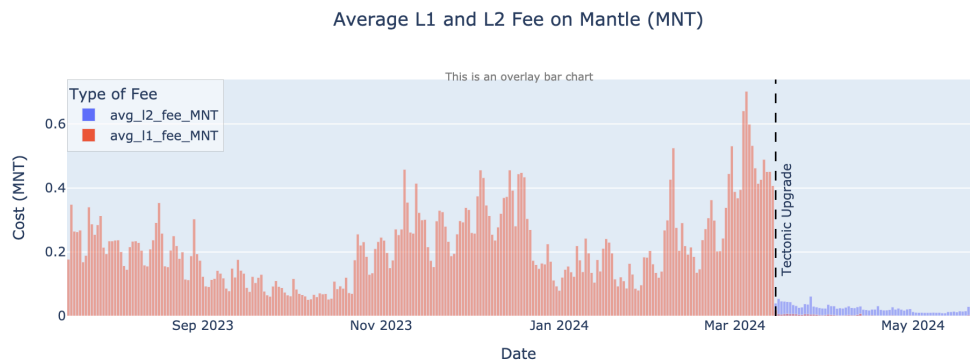
We can see the sharp drop in average L1 portion of the fee as a result of Tectonic upgrade.

Average transaction fee in $MNT:

Average Mantle Fee (MNT)

Average Mantle Fee (USD)

Descriptive statistics for average transaction fees in MNT:

Statistic	Value
Count	309.000000
Mean	0.177091
Standard Deviation	0.132940
Minimum	0.009871
25% Percentile	0.066728
Median	0.156080
75% Percentile	0.255746
Maximum	0.702289

Number of transactions and fee revenue:

Daily Fee Revenue (MNT) and Number of Transactions on Mantle Over Time
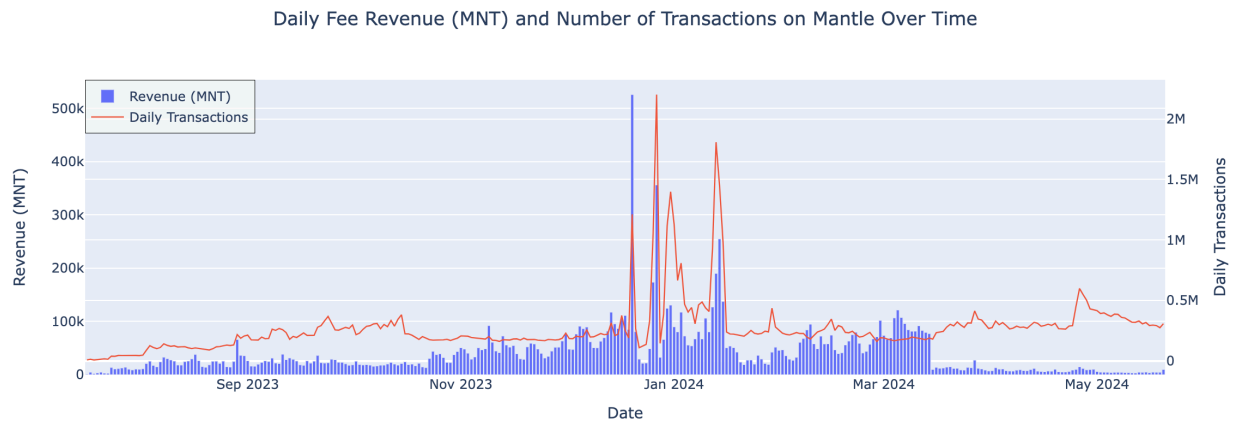
We can see a reduction in revenue as a result of Tectonic upgrade. It is important to note that the costs are reduced as well and will be covered in the profitability section. We will observe the profits and number of
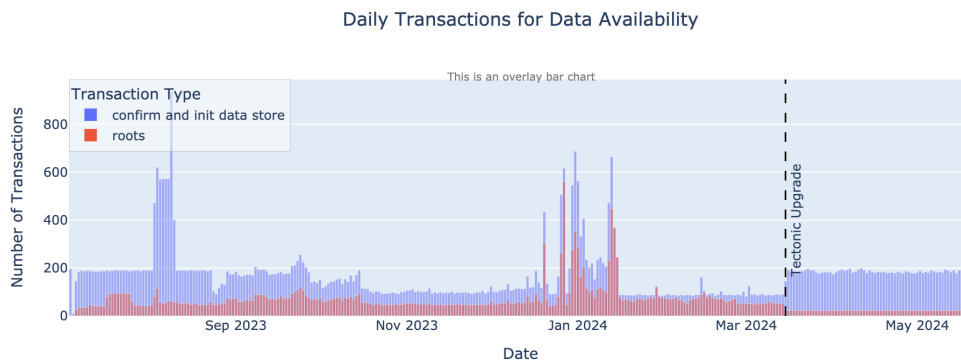
transactions in the profitability section.

Ratio Between L2 and L1 for an Average Fee on Mantle
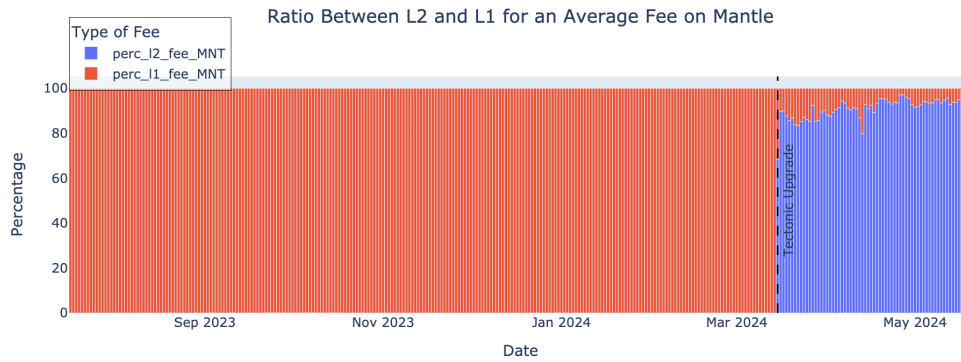
We can see that the L1 portion of the fee reduced significantly once the Tectonic upgrade was introduced.
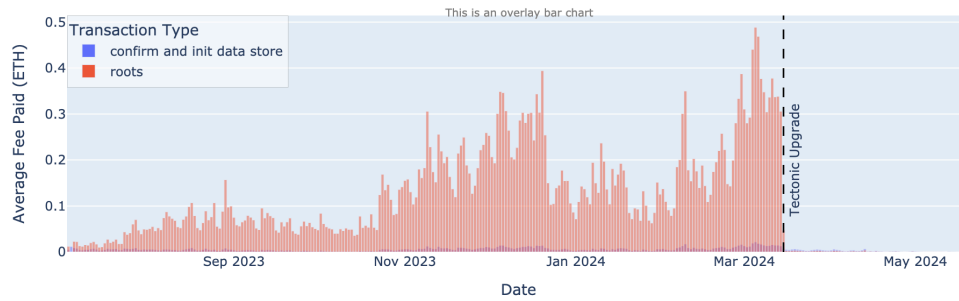
Costs (Transaction Fees paid by Committing for Ethereum Data Availability, Storage and Roots)

Number of transactions:

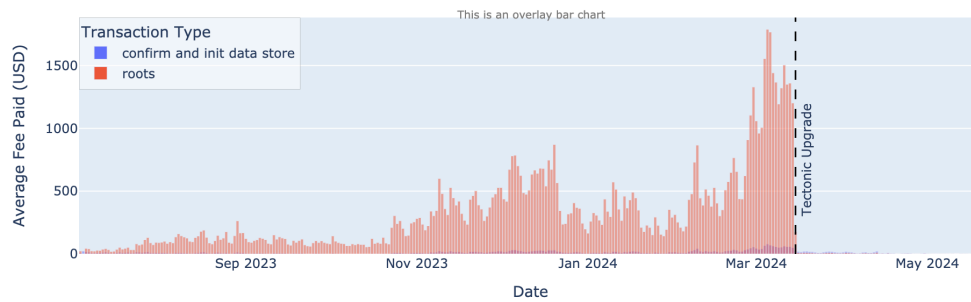Daily Transactions for Data Availability

Average daily fee:
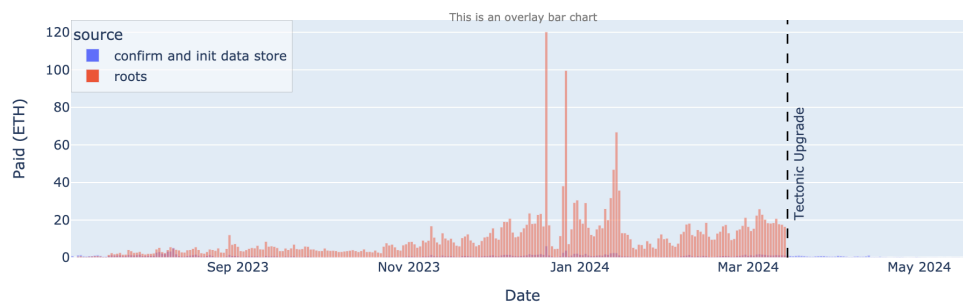
Average Daily Paid (per transaction) in ETH

Average Daily Paid (per transaction) in USD

We can see a sharp decline in average cost of Mantle L1 transactions as a result of Tectonic upgrade.

Daily Fee Paid for Data Availability (ETH)

Daily Fee Paid for Data Availability (USD)
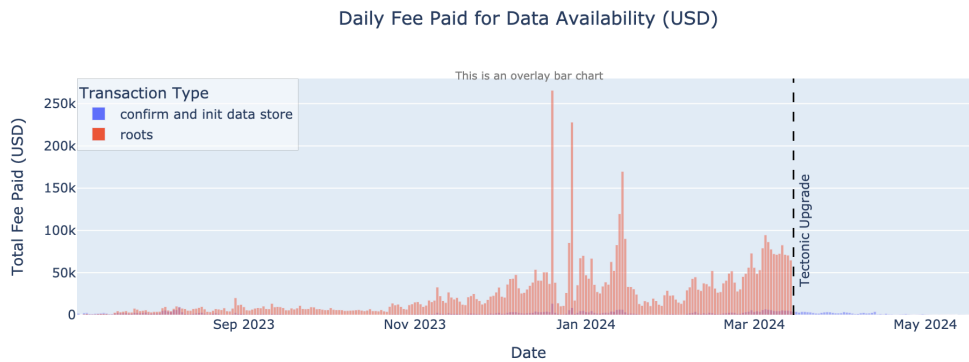
Naturally the total cost of Mantle L1 transactions dropped.

Average time between transactions:

Average Daily Time Difference (in Seconds) Between Transactions
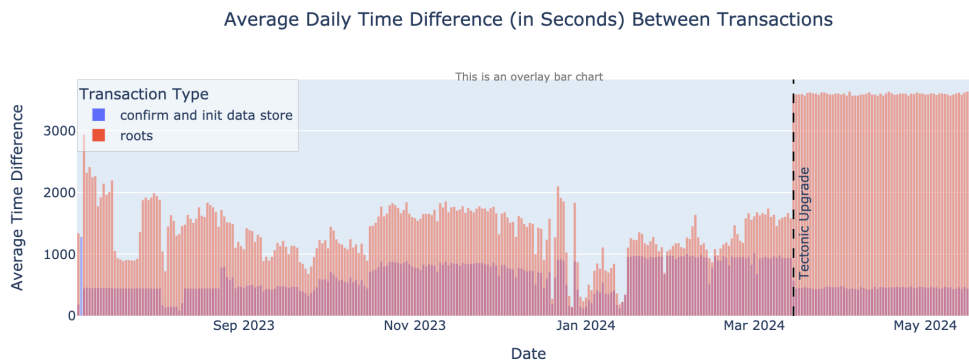
We can see that the Tectonic upgrade stabilized the time between transactions on L1.

Profitability (Transaction Fees paid by users of Mantle L2 Network - Transaction Fees paid by Committing for Data Availability)*

*we converted MNT to ETH as costs are denoted in ETH

Revenue vs Costs:

Daily Revenue vs Costs (ETH)
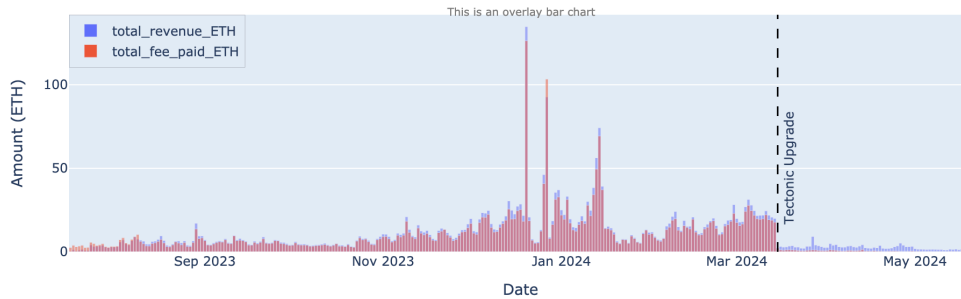
Daily profit:

Daily Profit (ETH if everything converted at average price) and Number of Transactions on Mantle Over Time
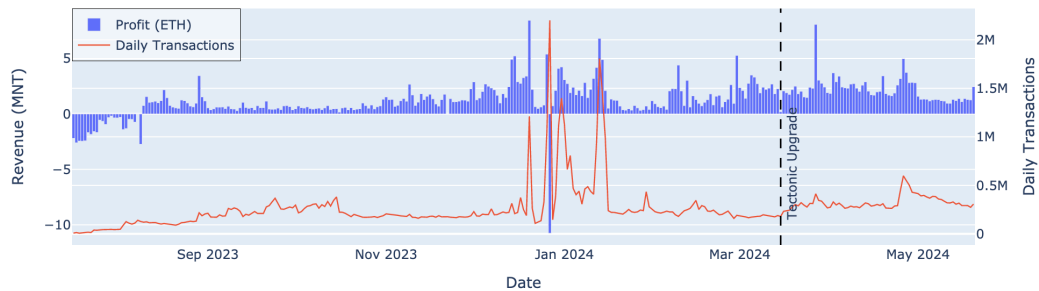
From the graph we can spot a sharp drop in profitability in December 2023. Feedback from the Mantle team is that it was the result of inscriptions. We can also see a higher profit on average with the same amount of daily transactions. This leads us to conclusion that the tectonic upgrade was good for Mantle profit wise.

Total profit:

Total Profit (ETH)

Conclusion

We can see that Tectonic upgrade lowered fees for users and at the same time allowed Mantle to maintain the higher profit on average than the previous months of 2024. Mantle's fee design certainly showcases an interesting approach of introducing a native token for transaction fee payments and managing the exchange rate between ETH and the network's native token. However for the L2 that is yet to come, this might not be needed in the initial stages as a native token might introduce additional friction to users.

Data tables

Monthly profit table:

Month	Total Profit (ETH)
2023-07	-21.9973
2023-08	17.8497
2023-09	16.8852
2023-10	17.5057
2023-11	38.6286
2023-12	67.2133
2024-01	54.105
2024-02	45.4755
2024-03	74.1932
2024-04	77.1588
2024-05	26.2753

Average Fee Info Before Tectonic Implementation (MNT)

Statistic	avg_mantle_fee_MNT
mean	0.2186118967682572
std	0.12063054785372568
min	0.0514785069029948
25%	0.1232967614071931
50%	0.1988981313778746
75%	0.2795929892482076
max	0.7022887922540857

Average Fee Info After Tectonic Implementation (MNT)

Statistic	avg_mantle_fee_MNT
mean	0.027119779429922504
std	0.013577467511166877
min	0.0098713678668287
25%	0.01590848777336645
50%	0.0247986414775827
75%	0.03359378255973505
max	0.0667277690976984

Average Fee Info Before Tectonic Implementation (USD)

Statistic	avg_mantle_fee_usd
mean	0.13229745150297334
std	0.11130436756469211
min	0.0171372404363956
25%	0.061163411462906
50%	0.1037057448173084
75%	0.1586706574403119
max	0.6626685457823632

Average Fee Info After Tectonic Implementation (USD)

Statistic	avg_mantle_fee_usd
mean	0.028973553040849784
std	0.013862632486961617
min	0.0099867514409507
25%	0.0153814215509424
50%	0.0260547856542459
75%	0.03810483445460725
max	0.0797933790734451

Descriptive Statistics for DA and Proofs Before Tectonic Upgrade

statistic	metric	confirm and init data store	roots
total_transactions	mean	166.05882352941177	75.33070866141732
total_transactions	std	122.06617086431692	59.83310848880052
total_transactions	min	10	3
total_transactions	25%	95	50
total_transactions	50%	125	60
total_transactions	75%	189	77
total_transactions	max	938	560
avg_time_diff	mean	651.5722226388397	1359.8075873967716
avg_time_diff	std	251.5224303261517	429.6674223632551
avg_time_diff	min	91.88059701492536	152.35714285714286
avg_time_diff	25%	450.26934001670844	1103.4294258373207
avg_time_diff	50%	654.2903225806451	1391.3870967741937
avg_time_diff	75%	868.5473684210526	1663.625
avg_time_diff	max	1285.2	2942.4
avg_fee_paid_ETH	mean	0.00658337577806875	0.13577439939274408
avg_fee_paid_ETH	std	0.0037319864407572754	0.09945586491436842
avg_fee_paid_ETH	min	0.0013676075758533	0.0103146564393987
avg_fee_paid_ETH	25%	0.00388852046178565	0.05609764772980513
avg_fee_paid_ETH	50%	0.0057190222571975	0.10464055511546344
avg_fee_paid_ETH	75%	0.008260376665147149	0.18863043504357124
avg_fee_paid_ETH	max	0.0218927301554175	0.4884908268338682

Descriptive Statistics for DA and Proofs After Tectonic Upgrade

statistic	metric	confirm and init data store	roots
total_transactions	mean	186.4848484848485	23
total_transactions	std	5.998057183512839	0
total_transactions	min	175	23
total_transactions	25%	182	23
total_transactions	50%	185.5	23
total_transactions	75%	191	23
total_transactions	max	202	23
avg_time_diff	mean	458.8474400898367	3598.363636363636
avg_time_diff	std	14.569868751220096	17.535137057741274
avg_time_diff	min	426.9504950495049	3571.304347826087
avg_time_diff	25%	445.160667539267	3588.6521739130435
avg_time_diff	50%	461.85457715780296	3599.7391304347825
avg_time_diff	75%	470.46982525671046	3606.782608695652
avg_time_diff	max	489.25714285714287	3638.608695652174
avg_fee_paid_ETH	mean	0.0026960876779765276	0.0014646748915824546
avg_fee_paid_ETH	std	0.001769802847494623	0.0009620965979045709
avg_fee_paid_ETH	min	0.0005258722066933	0.0002918190286833
avg_fee_paid_ETH	25%	0.00114644517884275	0.000616140976498525
avg_fee_paid_ETH	50%	0.0021827095293996497	0.00111563839597295
avg_fee_paid_ETH	75%	0.004141737729898625	0.00220175284955215
avg_fee_paid_ETH	max	0.0068022140351031	0.003821319748898