Competitor Economy Analysis

How our competitors are doing economics?

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=nil; Tech Talk

Agenda

- Motivation
- Transaction Fee Mechanisms (TFMs)
- TFMs on L2 Solutions + NEAR & TON
- Profitability Before & After EIP-4844
- Conclusion & Next Steps

Motivation

- Design a sustainable fee model for =nil;
- Examine competitors choices and characteristics to inform our fee model
- Examine on-chain revenue and costs
- Examine impact of EIP-4844 on their economics

Transaction Fee Mechanisms (TFMs)

Providing context

- TFM is a mechanism for allocating transactions into a block.
- It decides how much the user will pay per unit of gas, where this payment goes & what is burned
- TFM sets: allocation, payment and burning rules
- $\mathrm{transactionFee} = \mathrm{size} \cdot \mathrm{bidPerGasUnit}$

Transaction Fee Mechanisms (TFMs)

Overview of main ideas and their limitations

TFM	MMIC?	DSIC?	OCA-proof?
FPA	yes	no	yes
SPA	no	almost	almost
β-burn FPA	yes	no	no
1559	yes	usually	yes
β-burn 1559	yes	usually	no
tipless	yes	yes	usually

Transaction Fee Mechanisms (TFMs)

Short coverage of EIP-1559

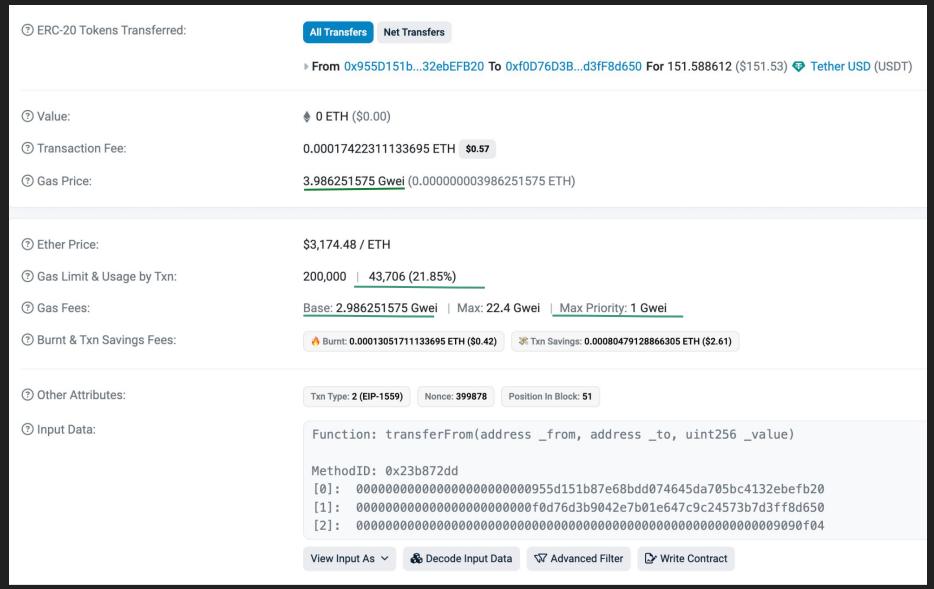
- Base fee adjusts based on past block congestion.
- Collected Base fees are burned.
- A transaction will be included in a block only if its fee cap is at least the block’s base fee.
- Tips are the main source of miner revenue.

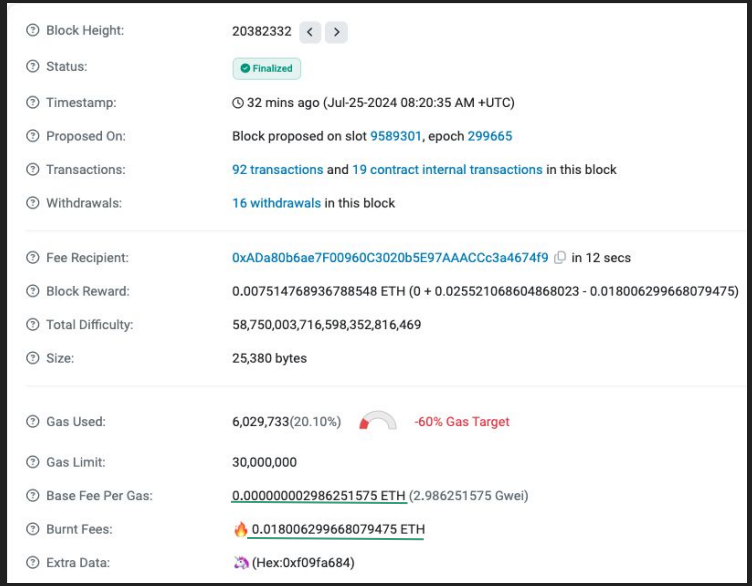
$$baseFee := baseFee_{\text{previous}} \cdot \left(1 + \frac{1}{8} \cdot \frac{gasUsed_{\text{previous}} - gasTarget}{gasTarget}\right)$$

$$\text{User pays: } \text{txSizeInGas} \cdot \min(\text{baseFee} + \text{tip}, \text{feeCap})$$

TFMs

EIP-1559 : How it looks like on Etherscan





Transaction Fee Mechanisms (TFMs)

What do l2s have to take into account when choosing/designing a TFM

- Sequencer/Proposers
- DA choice and associated costs
- Proof Verification and Generation costs (if zkRollup)
- Accounting for L1 fees (DA, proofs) in the fees themselves
- Fee revenue that will cover all these costs while being reasonably cheap to the end user
- Other specifics such as tips, preserving UX of Ethereum…

TFMs - What the market is using

Name	Type	General Fee design	EIP-4844	Fees paid in
Scroll	L2	pre EIP-1559 Curie introduced EIP-1559	Yes	ETH
Linea	L2	EIP-1559	Yes	ETH
Starknet	L2	Custom	Yes	STRK or ETH
ZKsync	L2	Custom	Yes	ETH
Arbitrum One	L2	Custom (UX same as EIP-1559)	Yes	ETH
Mantle	L2	Custom EIP-1559 with Token Ratio Addition	No	MNT
NEAR	L1	Tipless EIP-1559	/	NEAR
TON	L1	Custom	/	TON

Transaction Fee Mechanisms

Scroll - General idea & L2 portion

$$Fee = \mathrm{l2TransactionExecutionFee} + \mathrm{l1GasFee}$$

$$l2TransactionExecutionFee = l2TransactionGasUsed \cdot l2TransactionGasPrice$$

- L2 portion of the fees is used to cover proof verification and generation costs by setting the minimum acceptable gas price (this minimum is set manually)

Transaction Fee Mechanisms

Scroll - Pre upgrade L1 data fee

$$l1Gas = \text{zeros} \cdot \text{tx\_data\_zero\_gas} + (\text{nonzeros} + \text{additional\_non\_zero\_bytes}) \cdot \text{tx\_data\_non\_zero\_gas}$$

$$l1GasFee = (\text{l1Gas} + \text{overhead}) \cdot \text{l1BaseFee} \cdot 1.05$$

$$\begin{aligned}
\text{tx_data_zero_gas} &= 4 \\
\text{tx_data_non_zero_gas} &= 16 \\
\text{L1BaseFee} &= \text{changes every 30 seconds} \\
\text{additional_non_zero_bytes} &= 4 \\
\text{overhead} &= 56
\end{aligned}$$

Transaction Fee Mechanisms

Scroll - Current L1 data fee

$$\text{L1FeeCurie}(data) = \frac{\text{commitScalar} \times \text{l1BaseFee} + \text{blobScalar} \times \text{length}(data) \times \text{l1BlobBaseFee}}{\text{PRECISION}}$$

Transaction Fee Mechanisms

Starknet - General idea & L2 portion of the fees

- Averages gas price on l1 + 1 gwei
- The vector portion of fees is determined by the most restrictive component.
- Separate charge for resources and data on L2

$$
\begin{aligned}
&avg\_gas\_price\_L1 \cdot \Bigg(\max_k v_k w_k \\
&+message\_calldata\_cost \cdot 3t \\
&+(message\_calldata\_cost + l1\_log\_data\_cost) \cdot \sum_{i=1}^{t} q_i \\
&+(l1\_storage\_write\_cost + log\_message\_to\_l1\_cost) \cdot t \\
&+l2\_payload\_costs \Bigg)
\end{aligned}
$$

Transaction Fee Mechanisms

Starknet - Blob part of the fees

$$+avg\_data\_gas\_price\_L1 \cdot felt\_size\_in\_bytes \cdot (2(n-1) + 2(m-1) + \ell + 2D)$$

- m and n are always >1 since we have fee contract which is always updated (either ETH or STRK)
- There is still no refund if multiple transactions update the same storage cell

Transaction Fee Mechanisms

ZKsync - general idea

- End transaction fee depends on how close it brings the batch to being sealed
- Operator charges for worst case then refunds the extra charge
- At the start of each batch the operator provides fairL2GasPrice and fairPubdataPrice

Transaction Fee Mechanisms

ZKsync - let's explain the formula (at least part of it)

$$\text{baseFee} := \max\left(\text{fairL2GasPrice}, \left\lceil \frac{\text{fairPubdataPrice}}{\text{MAX\_L2\_GAS\_PER\_PUBDATA()}} \right\rceil\right)$$

$$\text{fair\_L2\_GasPrice} = \text{MINIMAL\_L2\_GAS\_PRICE} + \frac{\text{COMPUTE\_OVERHEAD\_PART} \times \text{BATCH\_OVERHEAD\_L1\_GAS}}{\text{MAX\_GAS\_PER\_BATCH}}$$

$$\text{fairPubdataPrice} = \text{PUBDATA\_BYTE\_ETH\_PRICE} + \frac{\text{PUBDATA\_OVERHEAD\_PART} \times \text{BATCH\_OVERHEAD\_L1\_GAS}}{\text{MAX\_PUBDATA\_PER\_BATCH}}$$

Transaction Fee Mechanisms

Arbitrum One

- Arbitrum accounts for the L1 fees in the Gas amount portion of the fee
- Gas amount then becomes L2 computation gas + L1 gas buffer
- Arbitrum's gas metering algorithm tracks a gas **backlog B**:
  - If a transaction consumes L2 gas, $B \leftarrow B + G$.
  - If T seconds elapse, $B \leftarrow \max(B - TS, 0)$, where S is the speed limit

Transaction Fee Mechanisms

Arbitrum One - Let's revisit the adjustment algorithm

- F_0 - minimum base fee
- B_0 - tolerance parameter
- B - backlog
- The scale factor β is chosen so that a 12 second period with gas usage double the speed limit would multiply the base fee by a factor of 9/8 = 1.125

$$F(B) = F_0 e^{\max(0,\beta(B-B_0))}$$

Transaction Fee Mechanisms

Arbitrum One - What about L1 costs

- Arbitrum has to account for L1 resources spent by a transaction
- If L2_gas_price rises, L1 gas used lowers
- Two challenges:
  - How to apportion these costs among transactions. Solution: Brotli compressor
  - Volatile L1 fees. Solution: Reimbursement sequencer fund

$$\text{gas\_used} = \text{L2\_gas\_used} + \frac{\text{L1\_calldata\_price} \times \text{L1\_calldata\_size}}{\text{L2\_gas\_price}}$$

Transaction Fee Mechanisms

Mantle - general idea and TFM

- EIP-1559
- Gas fees are paid in $MNT
- Uses tokenRatio for conversion
- FIFO with optional tips :)
- MantleDA
- Constants:
  - Overhead = 188
  - Scalar = 10000

L2 fee:

$$Fee = l2TransactionExecutionFee + L1RollupFee$$

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

L1 fee:

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

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

Transaction Fee Mechanisms

NEAR - general idea and TFM

- Tipless EIP-1559
- Maximum change of base fee is 1% per block
- 1 second block time
- It pays % of the base fee to smart contracts user interacted within the transaction.
- Encourages poor gas optimization on the developer’s side
- Overcharges users by about 60% then refunds
- Minimum gas price = 0.0001NEAR

Transaction Fee Mechanisms

TON - general idea

- Fixed network gas price
- 1 unit of gas = 0,0000004 TON Basechain
- 1 unit of gas = 0,00001 TON Masterchain
- Gas price can be changed by voting

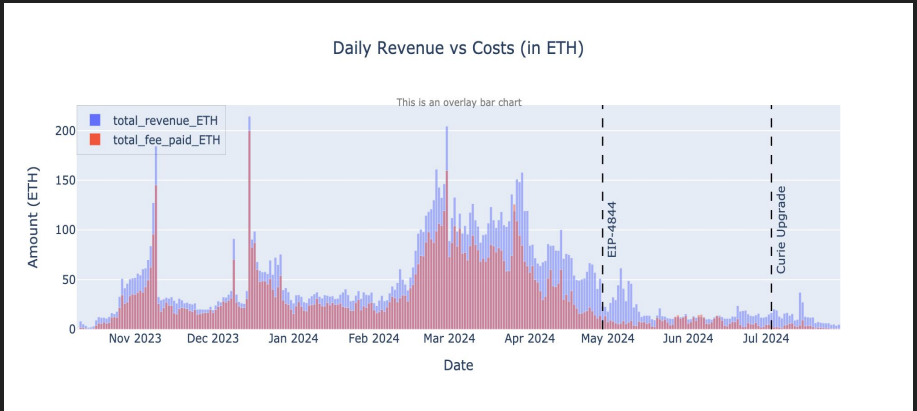
Profitability Before & After EIP-4844

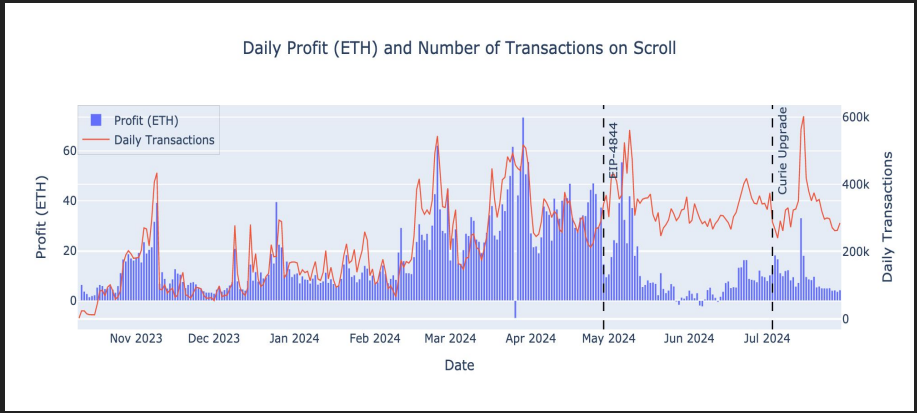
What happened to the median fee (in USD) after EIP-4844

Name	Before EIP-4844	After EIP-4844
Scroll	0.660063	0.115401
Linea	0.402120	0.025004
Starknet*	0.260000	0.010000
ZKsync	0.261079	0.022958
Mantle	0.118665	0.010954
Arbitrum	0.152297	0.005323

Profitability Before & After EIP-4844

Scroll - Revenue and Profitability





Profitability Before & After EIP-4844

Scroll - Revenue and Profitability

Profitability Before Blobs (92 days)

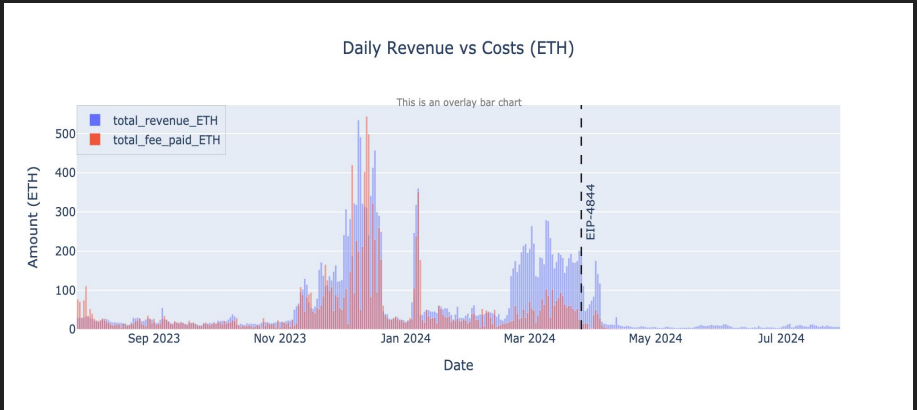
	total_revenue_ETH	total_fee_paid_ETH	profit_ETH
count	92	92	92
mean	85.6094	56.932	28.6774
std	37.2931	31.6917	14.2103
min	23.8812	11.2831	-7.03197
25%	52.1773	28.1208	19.1127
50%	85.0217	58.0049	27.6817
75%	110.668	80.5057	37.4824
max	204.493	159.855	73.4517

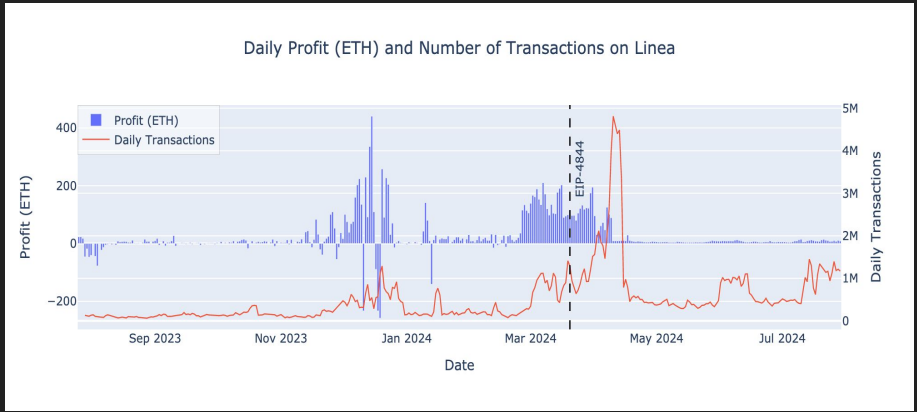
Profitability After Blobs (92 days)

	total_revenue_ETH	total_fee_paid_ETH	profit_ETH
count	92	92	92
mean	16.2496	6.28849	9.96108
std	9.97674	3.7711	9.95152
min	4.06475	0.442217	-2.36735
25%	11.0441	3.31121	4.24046
50%	13.0925	5.85941	7.40852
75%	18.0036	8.67818	12.0052
max	61.685	15.0408	55.5156

Profitability Before & After EIP-4844

Linea - Revenue and Profitability





Profitability Before & After EIP-4844

Linea - Revenue and Profitability

Profitability Before Blobs (126 days)

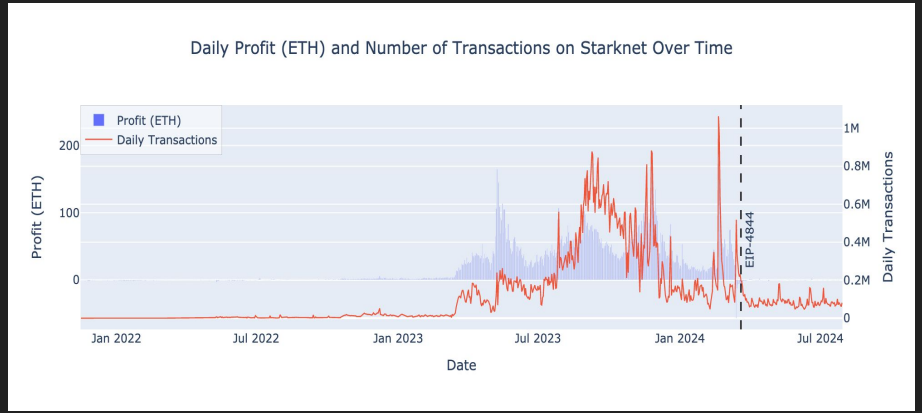
	total_revenue_ETH	total_fee_paid_ETH	profit_ETH
count	126	126	126
mean	137.125	75.5968	61.5282
std	113.706	94.7982	95.5692
min	20.0791	6.11411	-258.393
25%	38.9546	25.2722	8.36008
50%	124.527	46.6619	30.492
75%	195.871	83.0606	115.406
max	535.079	544.43	440.608

Profitability After Blobs (126 days)

	total_revenue_ETH	total_fee_paid_ETH	profit_ETH
count	126	126	126
mean	15.9126	2.48877	13.4238
std	30.4384	7.29822	25.1938
min	3.58233	0.0104268	3.17966
25%	5.37092	0.0422974	4.98192
50%	7.67376	0.629328	6.97307
75%	10.7916	1.60593	9.3764
max	198.372	50.1326	194.961

Profitability Before & After EIP-4844

Starknet - revenue and profitability



Profitability Before & After EIP-4844

Starknet - total profit

Profitability Before Blobs (132 days)

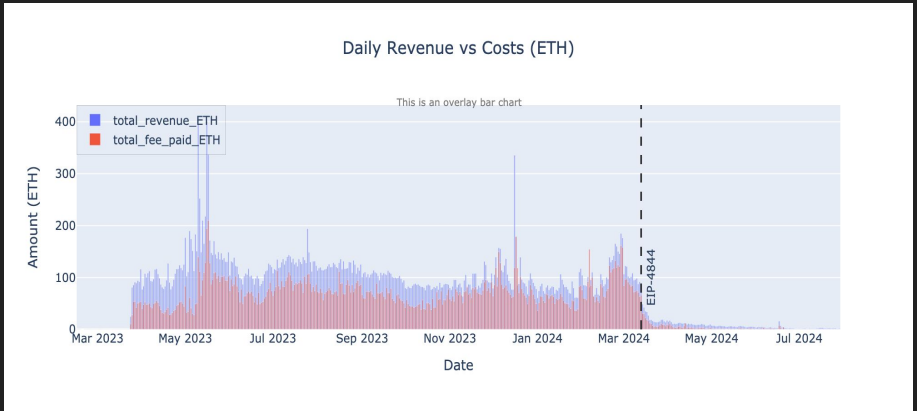
	total_revenue_ETH	total_fee_paid_ETH	profit_ETH
count	132	132	132
mean	56.0301	10.3925	45.6376
std	45.3035	8.1248	41.2965
min	1.54041	2.34449	-57.0535
25%	24.0633	5.20885	18.502
50%	41.918	8.35798	34.9989
75%	77.6116	12.9318	61.933
max	262.873	62.4201	243.727

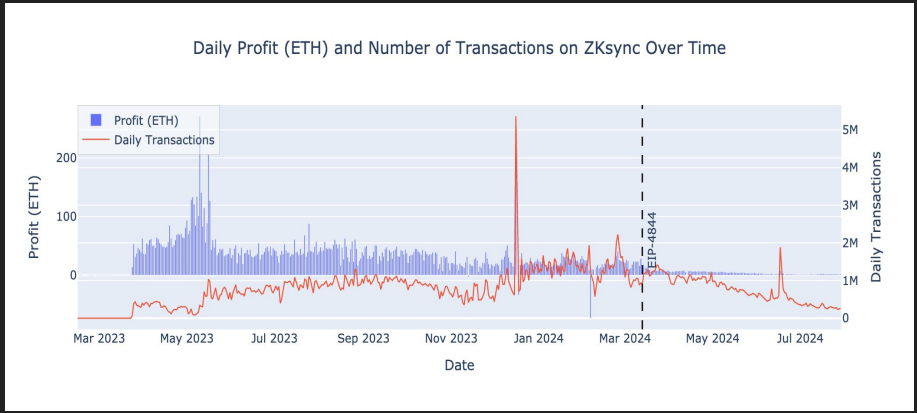
Profitability After Blobs (132 days)

	total_revenue_ETH	total_fee_paid_ETH	profit_ETH
count	132	132	132
mean	0.50604	0.894088	-0.388048
std	0.646132	0.984116	0.803387
min	0.0564461	0.0888087	-5.20164
25%	0.164118	0.38366	-0.508271
50%	0.255372	0.574197	-0.286515
75%	0.552874	1.1185	-0.149305
max	3.28994	7.32916	2.15975

Profitability Before & After EIP-4844

ZKsync - revenue and profitability





Profitability Before & After EIP-4844

ZKsync - total profit

Profitability Before Blobs (139 days)

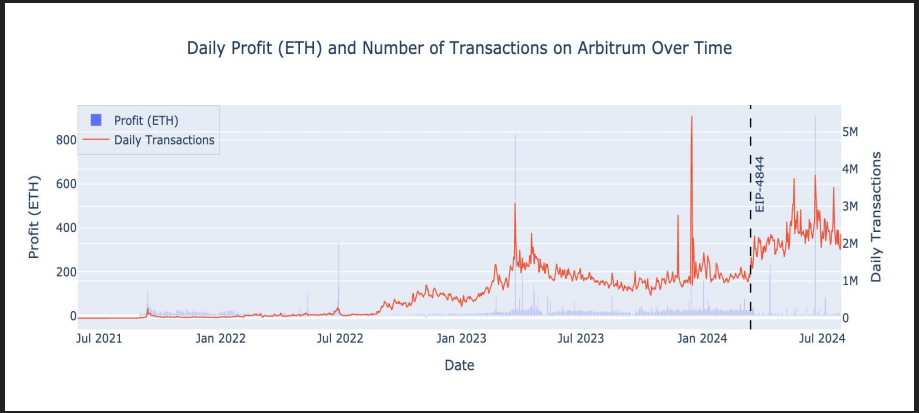
	total_revenue_ETH	total_fee_paid_ETH	profit_ETH
count	139	139	139
mean	98.2635	76.2831	21.9804
std	32.2328	25.8301	20.8124
min	60.8118	36.3146	-73.2389
25%	81.1769	59.9966	16.4533
50%	88.8571	71.0695	21.0387
75%	106.705	84.5778	26.4612
max	335.648	179.19	216.679

Profitability After Blobs (139 days)

	total_revenue_ETH	total_fee_paid_ETH	profit_ETH
count	139	139	139
mean	8.34384	3.7487	4.59514
std	9.64358	7.30018	3.06796
min	1.37576	0.124359	0.196635
25%	2.6136	0.619813	1.89422
50%	5.57074	1.48193	4.28722
75%	10.5248	3.76827	6.65871
max	78.7099	66.0591	17.7702

Profitability Before & After EIP-4844

Arbitrum - revenue and profitability



Profitability Before & After EIP-4844

Arbitrum - profits

Profitability Before Blobs (138 days)

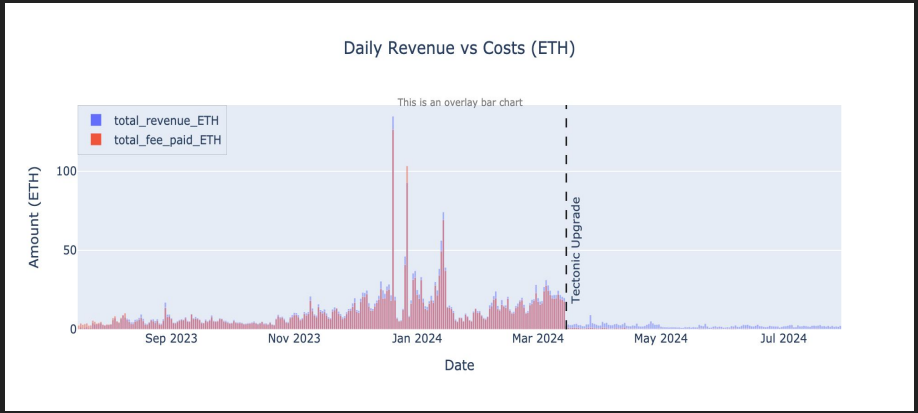
	total_revenue_ETH	total_fee_paid_ETH	profit_ETH
count	138	138	138
mean	123.968	94.2156	29.7529
std	94.0336	80.4407	19.4778
min	37.8186	22.0337	15.7849
25%	82.1445	58.3631	23.6064
50%	100.245	75.5179	26.1528
75%	137.547	109.74	28.9685
max	947.044	763.845	183.2

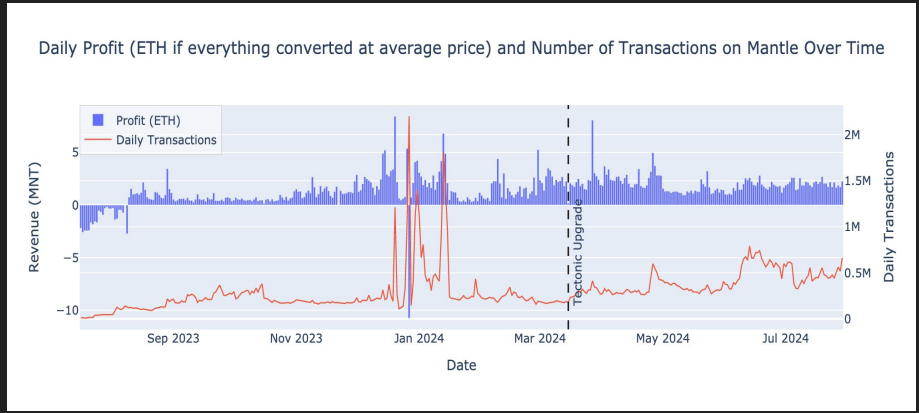
Profitability After Blobs (138 days)

	total_revenue_ETH	total_fee_paid_ETH	profit_ETH
count	138	138	138
mean	21.1655	2.52006	18.6455
std	85.1514	8.05102	81.0612
min	2.96455	0.269011	2.61856
25%	4.65762	0.630205	3.8067
50%	6.30694	1.03334	5.0107
75%	11.2465	1.60482	8.19149
max	956.24	80.5913	909.454

Profitability Before & After EIP-4844

Mantle - revenue and profitability





Profitability Before & After EIP-4844

Mantle - profits

Profitability Before Tectonic (137 days)

	total_revenue_ETH	total_fee_paid_ETH	profit_ETH
count	137	137	137
mean	18.5613	16.8003	1.76104
std	15.4315	14.9519	1.71089
min	5.19104	4.81511	-10.7572
25%	10.7819	9.92543	0.923063
50%	15.1833	13.665	1.47597
75%	21.4009	18.9204	2.33444
max	134.793	126.35	8.44253

Profitability After Tectonic (137 days)

	total_revenue_ETH	total_fee_paid_ETH	profit_ETH
count	137	137	137
mean	2.40442	0.394981	2.00944
std	0.992427	0.34192	0.843215
min	1.08247	0.0460326	0.195065
25%	1.77313	0.165449	1.49038
50%	2.19952	0.265836	1.89093
75%	2.86694	0.492571	2.31302
max	9.18343	2.21026	8.07175

Conclusion & Next Steps

- We discovered 4 approaches to pricing user’s transactions
- EIP-4844 generally reduced daily profits unless L2 is using custom DA
- Volume of transactions is influenced by Airdrop speculation
- Spikes in blob fees can increase L1 costs
- We can expect a rise in l2 fees or further optimizations in L1 fees paid by L2s
- Obvious choice between low fees and profitability
- Design of our fee model is underway taking inspiration from previously mentioned models

Thank you!

Questions?