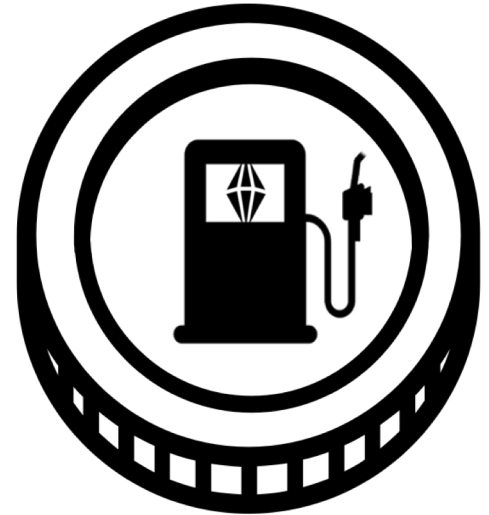


GasToken: A Journey Through Blockchain Resource Arbitrage

Florian Tramèr

Joint work with Phil Daian, Lorenz
Breidenbach, Ari Juels



Imagine if...

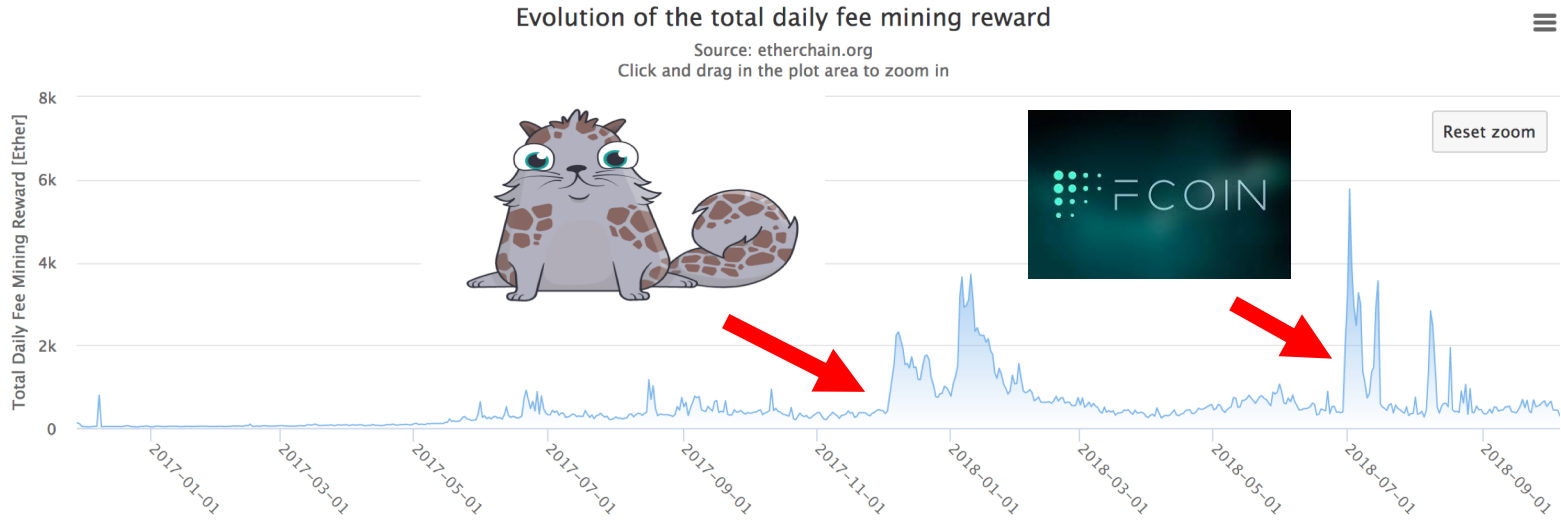


Monday: It's \$4 for the cappuccino... and the transaction fee is \$0.10.

Friday: It's \$4 for the cappuccino... and the transaction fee is \$6.25.



Transaction fees / Ethereum gas prices are super volatile



Same in Bitcoin...

source: bitinfocharts.com

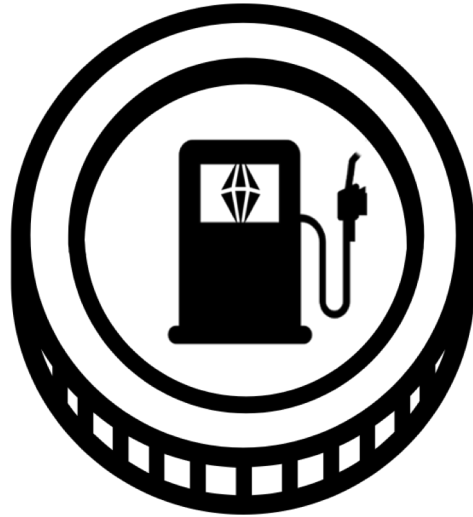


How do ordinary businesses handle volatility?

- Stock up when prices are low!
 - Or buy financial instruments...
- How do you “speculate on” or stockpile transaction fees?



GasToken: Stockpiling and trading Ethereum gas



<https://gastoken.io>



Ethereum Gas

```
MyContract  
  
func(x):  
  a = x + 1  
  b = hash(a)  
  Mem[0] = b
```

← 3 gas
← 30 gas
← 20000 gas
20033 gas

1 GWei = 10^9 Wei
1 Ether = 10^{18} Wei

User

I want to run
`func(1)`

1 GWei per gas?
(0.00002 eth)

How Much?

Miner(s)

Meh...



Ethereum Gas

```
MyContract  
  
func(x):  
  a = x + 1  
  b = hash(a)  
  Mem[0] = b
```

← 3 gas
← 30 gas
← 20000 gas
20033 gas

1 GWei = 10^9 Wei
1 Ether = 10^{18} Wei

User

I want to run
`func(1)`

10 GWei per gas?
(0.0002 eth)

How Much?

Miner(s)

OK!

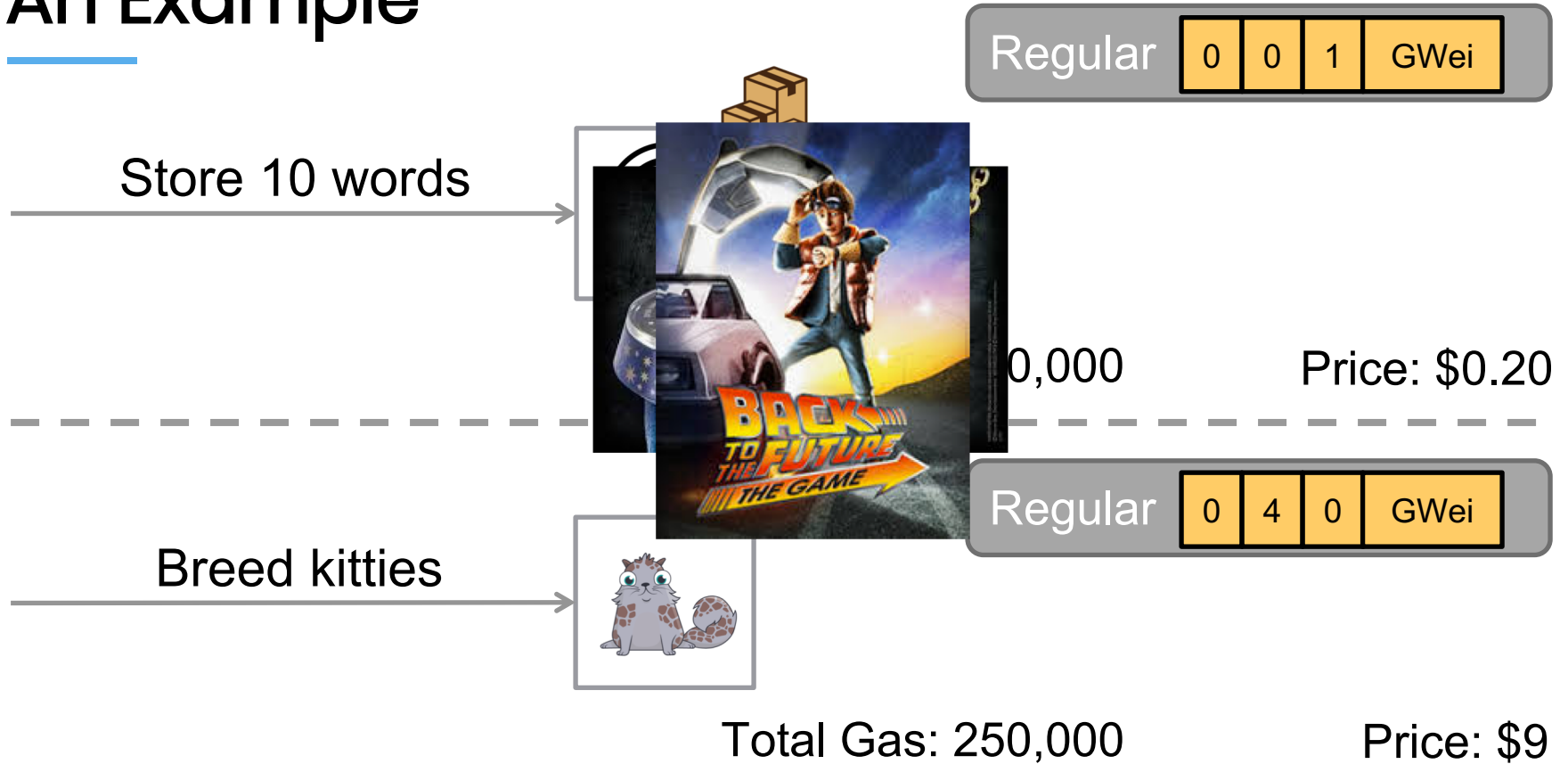


GasToken in a nutshell

- Changes to the global state are expensive!
 - Writing to contract storage, creating a contract
- To encourage state cleanup, Ethereum offers gas refunds for:
 - Released contract storage, destroyed contracts
- GasToken part 1: write state when gas price is low
 - Trade state slots as an ERC20 token
- GasToken part 2: erase state when gas price is high
 - Refund pays up to half of transaction fee

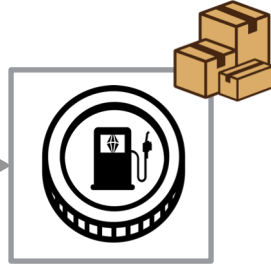


An Example



An Example

Store 10 words



Regular

0

0

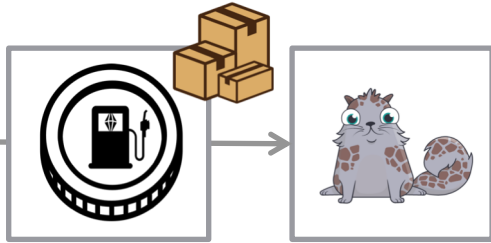
1

GWei

Total Gas: 200,000

Price: \$0.20

Free 10 words
& breed kitties



Regular

0

4

0

GWei

refund

Total Gas: 250,000 – 100,000

Price: ~~\$3~~ \$5



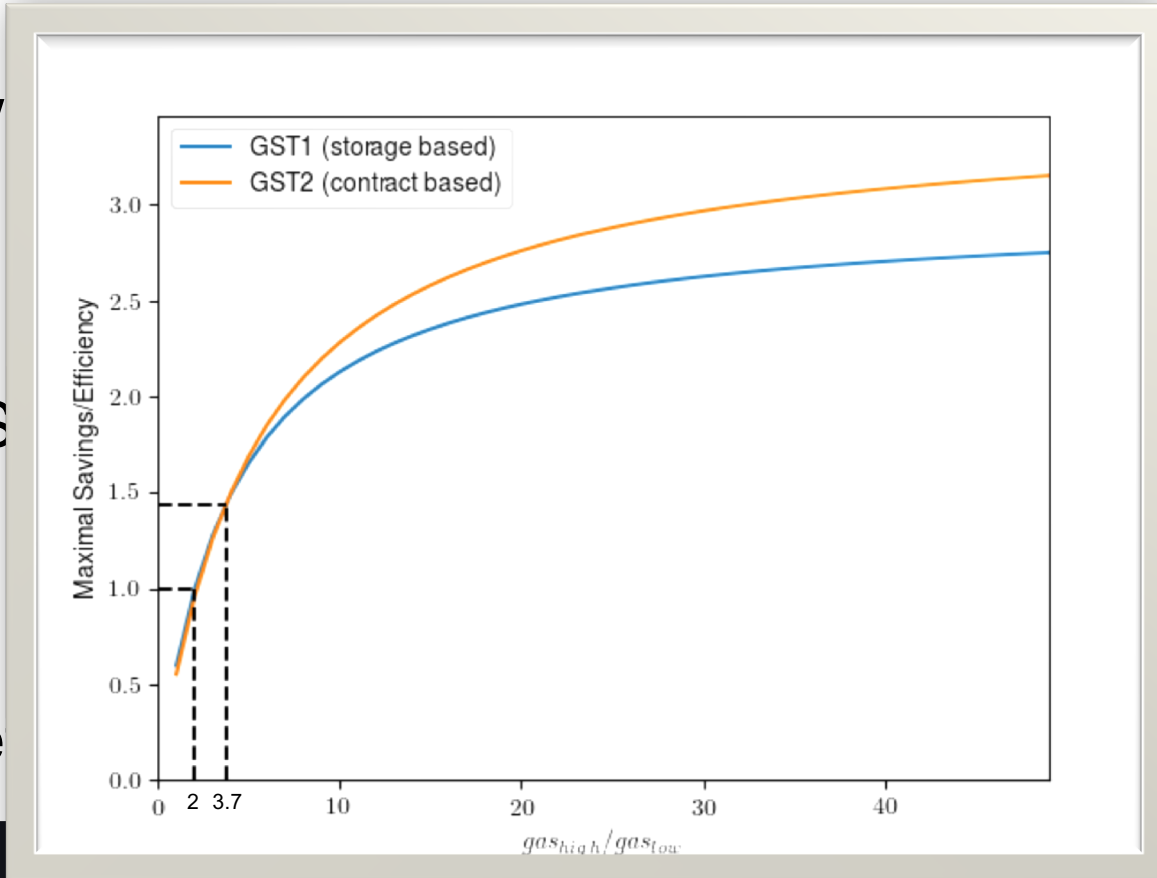
Nifty Details

- Two variants of GasToken:
 - GST1: uses storage, `SSTORE(1)`, `SSTORE(0)`
 - GST2: uses contracts, `CREATE`, `SELFDESTRUCT`
- GST2 more complex but also more efficient
 - `SSTORE`: 20k to stock, for 10k refund (50%)
 - `CREATE`: 32k to stock, for ~17k refund (53%)
- Refund is interesting when gas volatility is $>2x$



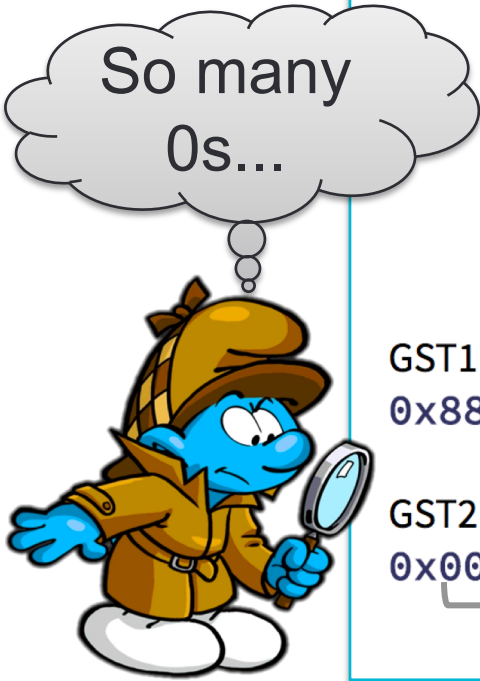
Nifty Details

- Tw
-
-
- GS
-
-
- Re



E(θ)
 STRUCT
 (%)
 2x





GasToken.io

GST1 is registered on ENS at `gst1.gastokenio.eth`, and is deployed at `0x88d60255F917e3eb94eaE199d827DAd837fac4cB`.

GST2 is registered on ENS at `gst2.gastokenio.eth` and is deployed at `0x000000000000b3F879cb30FE243b4Dfee438691c04`.

40 bits



Do people use it?



Philippe Castonguay

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Computational neuroscience research

Jun 4 · 10 min read

Turning Smart Contracts Into GasToken Factories

Or, how to make money while freeing the Ethereum blockchain from useless data.

Summary [ERC-20]

Total Supply:	7,770.81 GST2 (\$0.00)
Price:	\$0.0000 @ 0.000000 Eth
Holders:	16 addresses
Transfers:	56

FCOIN or airdrops might have massively benefited from this, but didn't

There is some evidence that arbitrage bots are using GasToken-like techniques to boost their margins

So far not much...



San Francisco
BLOCKCHAIN WEEK

The Issue With Storage Pricing

- Blockchain state is (a priori) permanent
 - Smart contract storage, UTXO set, etc.
- One time transaction fee \Rightarrow recurring & indefinite costs to network
- Writing to state must be expensive to deter DOS attacks
- Yet users should have incentives to clean up
 - E.g., many transactions in Bitcoin's UTXO have no positive incentive to be spent

Why 20K
gas for
SSTORE?



Storage Rent

- EIP 35/87: Charge “rent” for contract storage
 - If rent unpaid, storage is removed from chain
 - Refund scheme could be removed entirely
- Great idea but tricky execution
 - Developers must guard against storage loss
 - Entire contracts could disappear if unpaid
- Doesn't work for UTXO set...

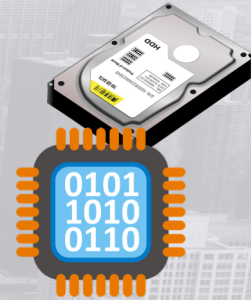


The Big Picture: Project Chicago

Project Chicago

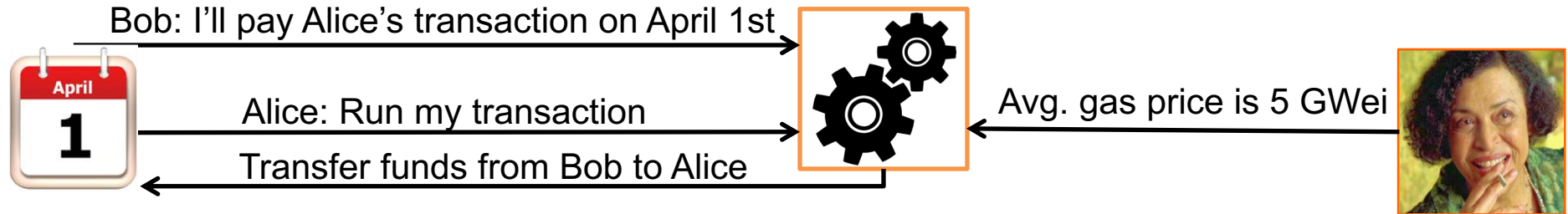
For the study of
cryptocommodities

- Blockchain transactions require a number of “raw” resources or commodities
 - Memory: block space, UTXO set, etc.
 - Computation: e.g., gas in Ethereum
- How do we accurately price and freely trade these commodities (and their derivatives)?



Project Chicago: What's Next?

- More efficient transaction-fee derivatives



- Other cryptocommodities?
- In-protocol futures
 - Could stable & efficient cryptocommodity markets be supported at the consensus level?



Learn More

<https://gastoken.io>



GasToken.io

★ Star projectchicago/gastoken on GitHub

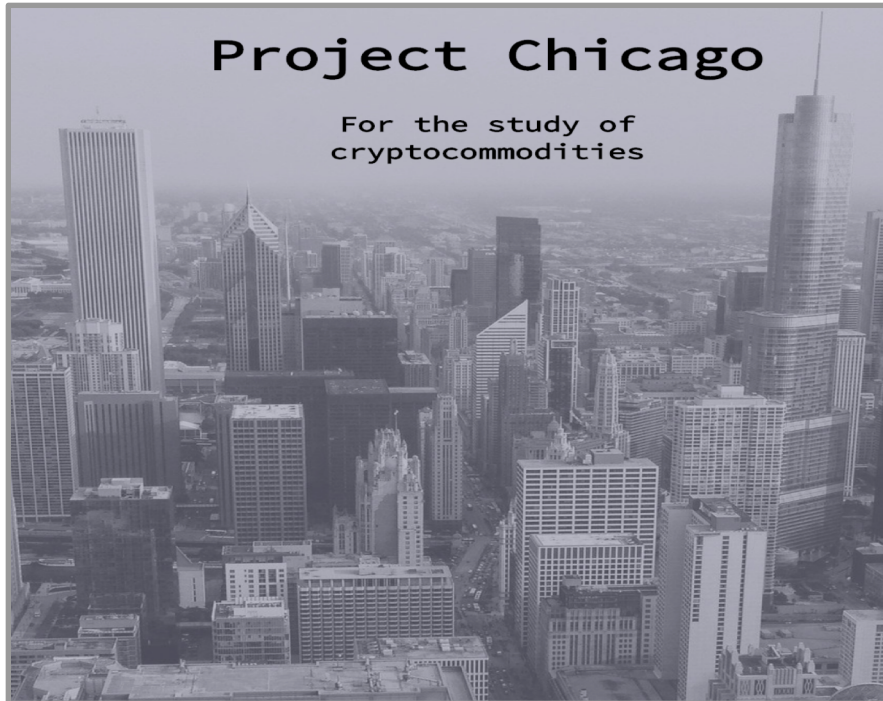
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<https://projectchicago.io>

Project Chicago

For the study of
cryptocommodities



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BLOCKCHAIN WEEK