Updating Gas Cost Schedule

Based on reproducible benchmarks

Ethereum Foundation Grant Research

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imapp

Gas Cost Schedule

OPCODE	Name	Gas Cost
01	ADD	3
02	MUL	5
09	MULMOD	8
0A	EXP	static: 10 dynamic: 50 * exponent size
60 - 7F	PUSHx	3
52	MSTORE	static: 3 dynamic: 3 * expanded memory
precompile 0x01	EcRecover	3000

Motivation

- Gas cost schedule updated to match real execution costs
- Promote client diversity
- Network security and vector of attack
- Decentralization and balanced network
- Smart contract code quality and optimizations

Goals

- Effective measurement methodology
- Reproducible results
- Automated tooling
- Updated Gas Cost Schedule

Part 1
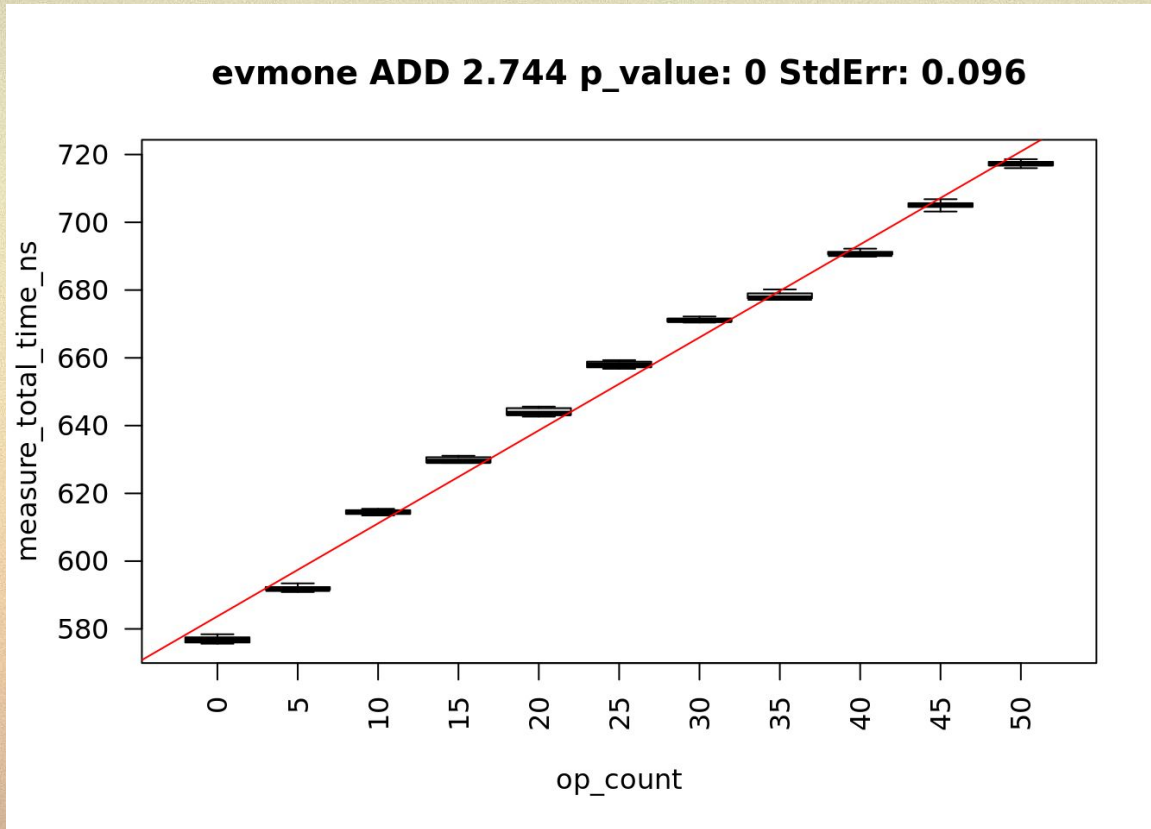
Research

Series of Test Programs

Intro bytecode	ADD		Cleanup bytecode

Intro bytecode	ADD	ADD	Cleanup bytecode

Intro bytecode	ADD	ADD	ADD	...	ADD	ADD	Cleanup bytecode

Single Measurement

evmone ADD 2.744 p_value: 0 StdErr: 0.096

Client Results

evmone no outliers
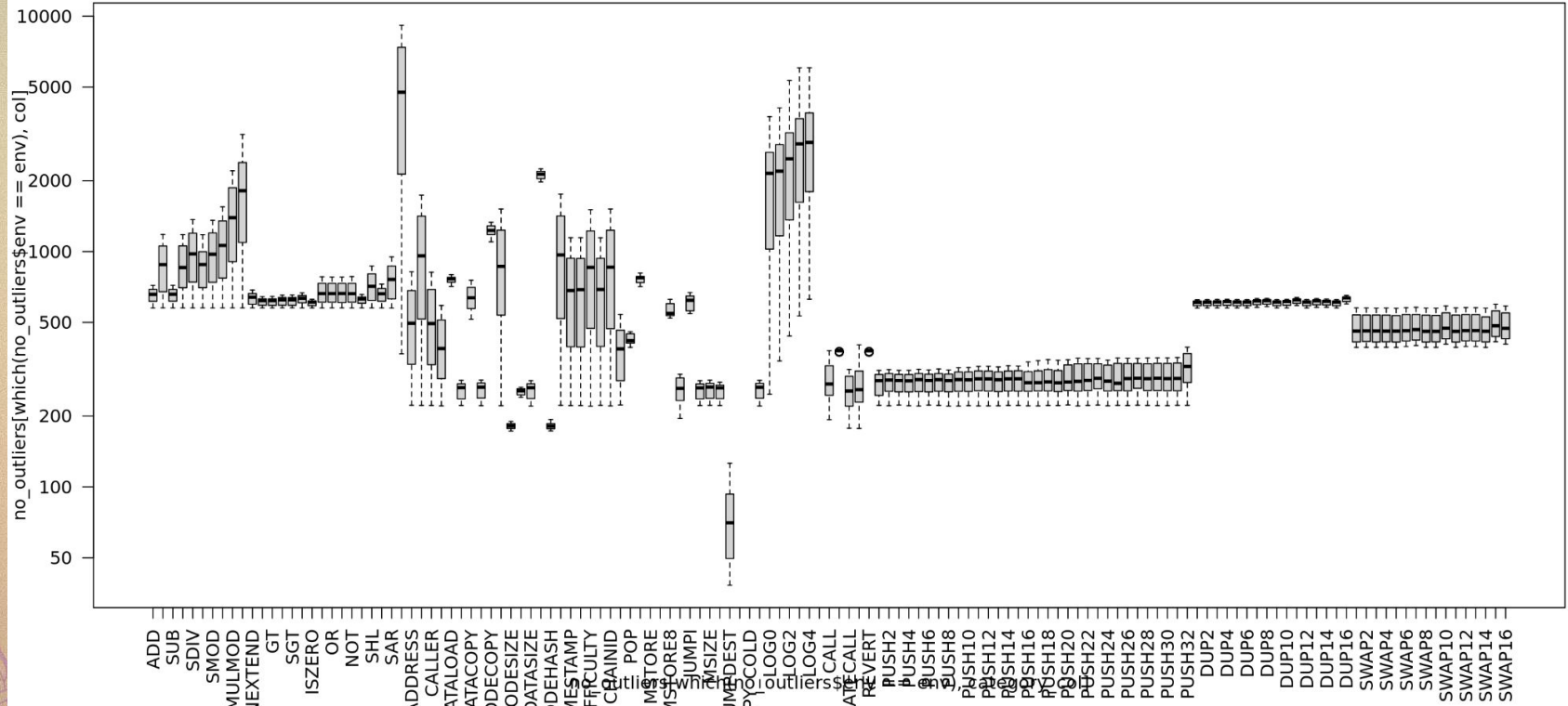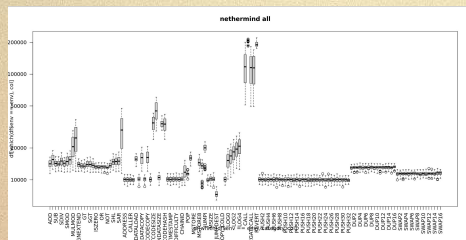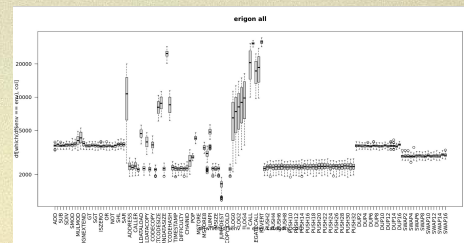
All Clients

Scaled Results
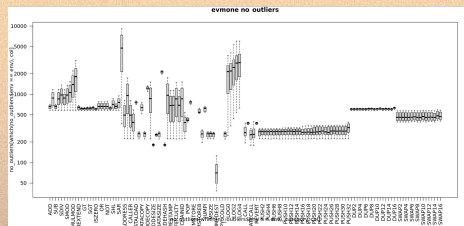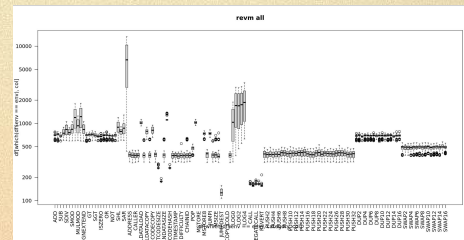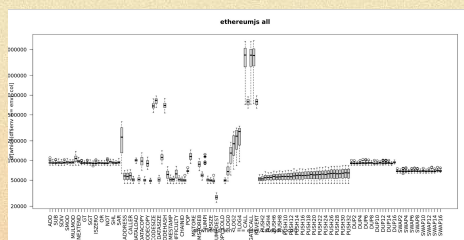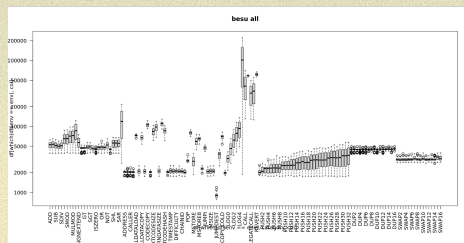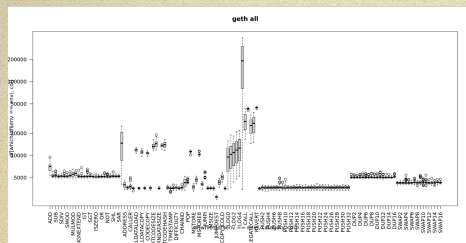
The scaled gas costs
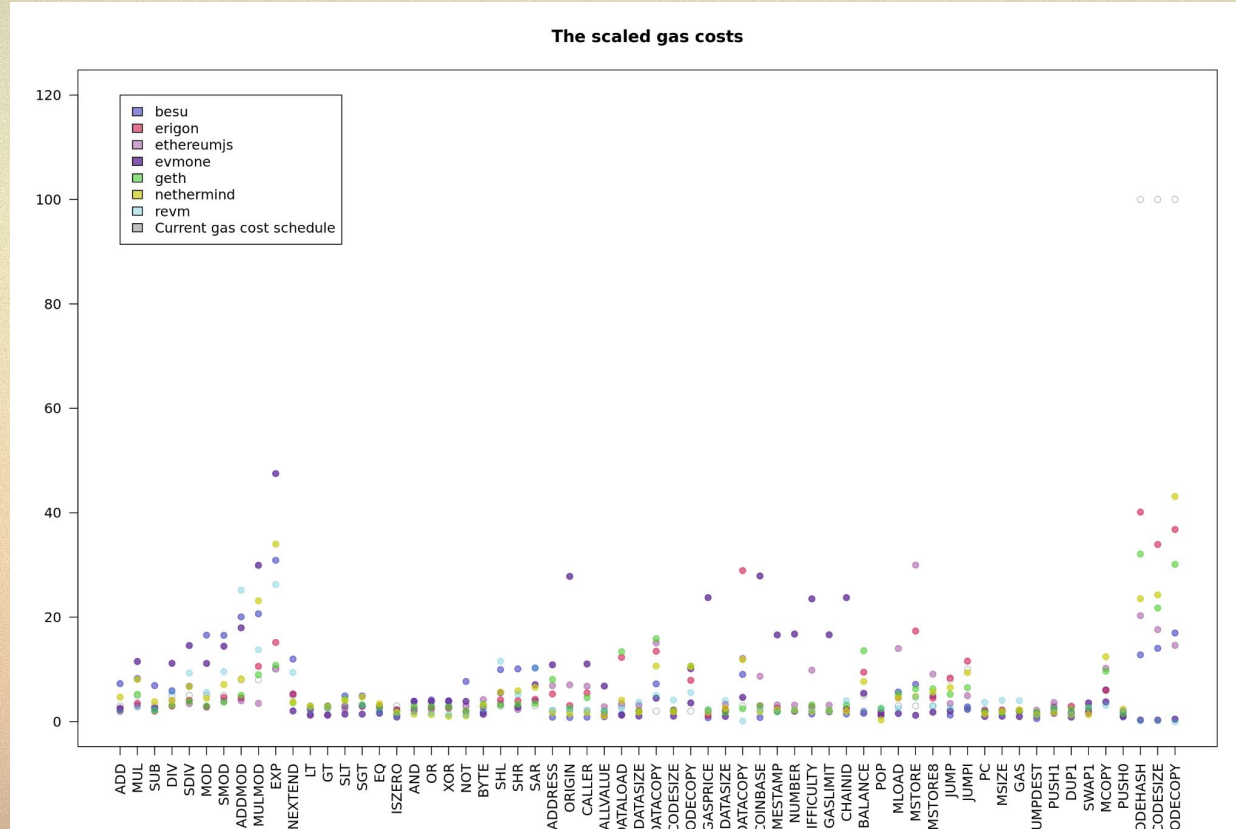
Part 2

Proposal

Conservative Update

OPCODE	Name	Current	Proposal
01	ADD	3	3
02	MUL	5	5
09	MULMOD	8	14
0A	EXP	static: 10 dynamic: 50 * exponent size	static: 10 dynamic: 20 * exponent size
60 - 7F	PUSHx	3	3
52	MSTORE	static: 3 dynamic: 3 * expanded memory	static: 3 dynamic: 3 * expanded memory
precompile 0x01	EcRecover	3000	12000

Conservative Update

OPCODE	Name	Current	Proposal
01	ADD	3	3
02	MUL	5	5
09	MULMOD	8	14
0A	EXP	static: 10 dynamic: 50 * exponent size	static: 10 dynamic: 20 * exponent size
60 - 7F	PUSHx	3	3
52	MSTORE	static: 3 dynamic: 3 * expanded memory	static: 3 dynamic: 3 * expanded memory
precompile 0x01	EcRecover	3000	12000

Radical Update

OPCODE	Name	Current	Proposal
01	ADD	3	1
02	MUL	5	1
09	MULMOD	8	4
0A	EXP	static: 10 dynamic: 50 * exponent size	static: 3 dynamic: 5 * exponent size
60 - 7F	PUSHx	3	1
52	MSTORE	static: 3 dynamic: 3 * expanded memory	static: 1 dynamic: 1 * expanded memory
precompile 0x01	EcRecover	3000	3000

Conservative

- Minimizes the scope of changes
- Minimizes effect on the network
- Easier to implement

Radical

- Reflects improvement in computational cost
- Widens the gap between computational and state changes costs
- Promotes data saving techniques
- Forces client configurability

Thank you!

https://github.com/imapp-pl/gas-cost-estimator

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