Isaac Sheff

BEYOND OPTIMAL:

COMPILER BLACK MAGIC BASED ON EQUIVALENT EXCHANGE

BEYOND OPTIMAL

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Asmodeus

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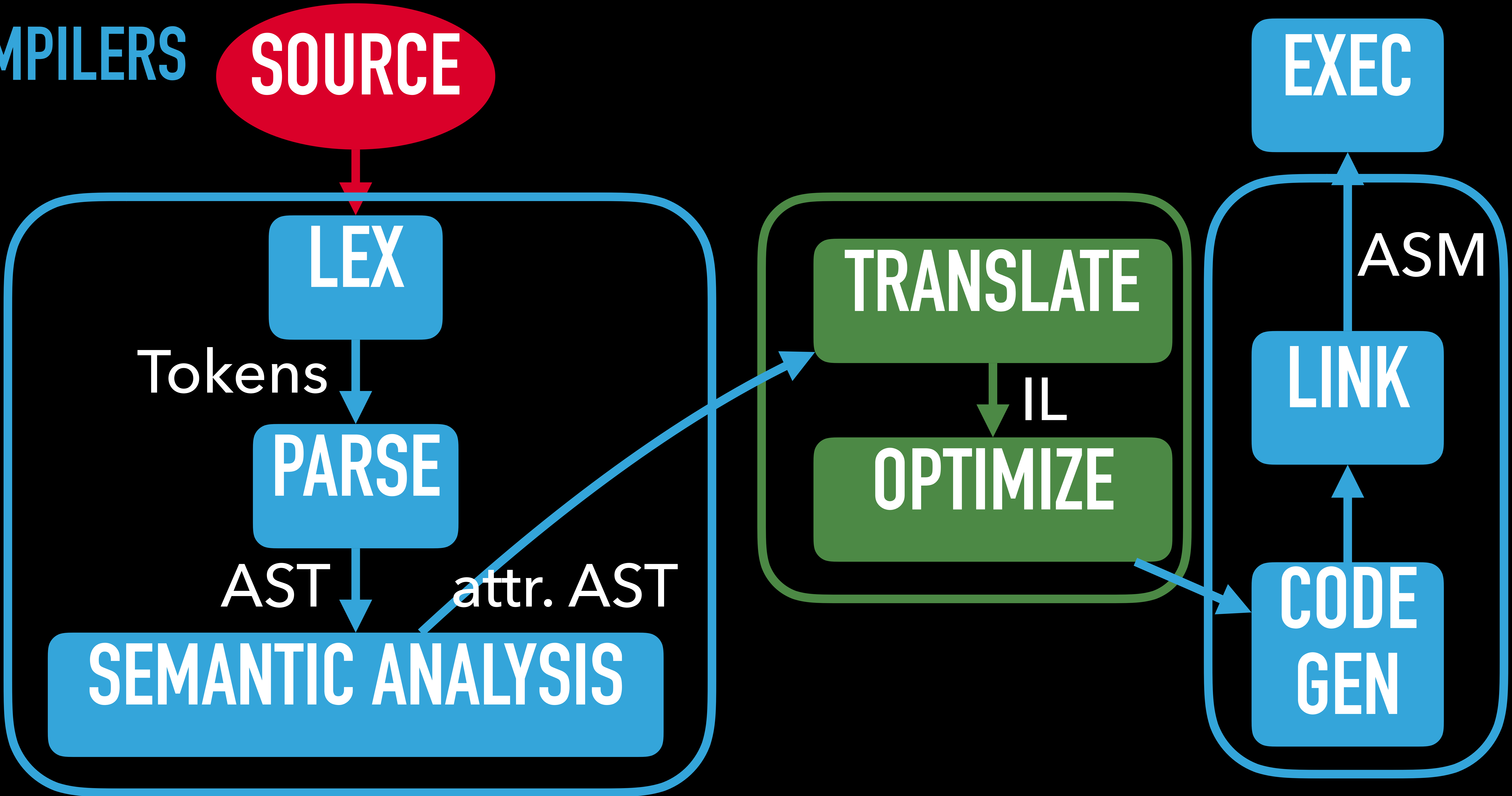
“The Dwarf”

“the flask”

BACKGROUND

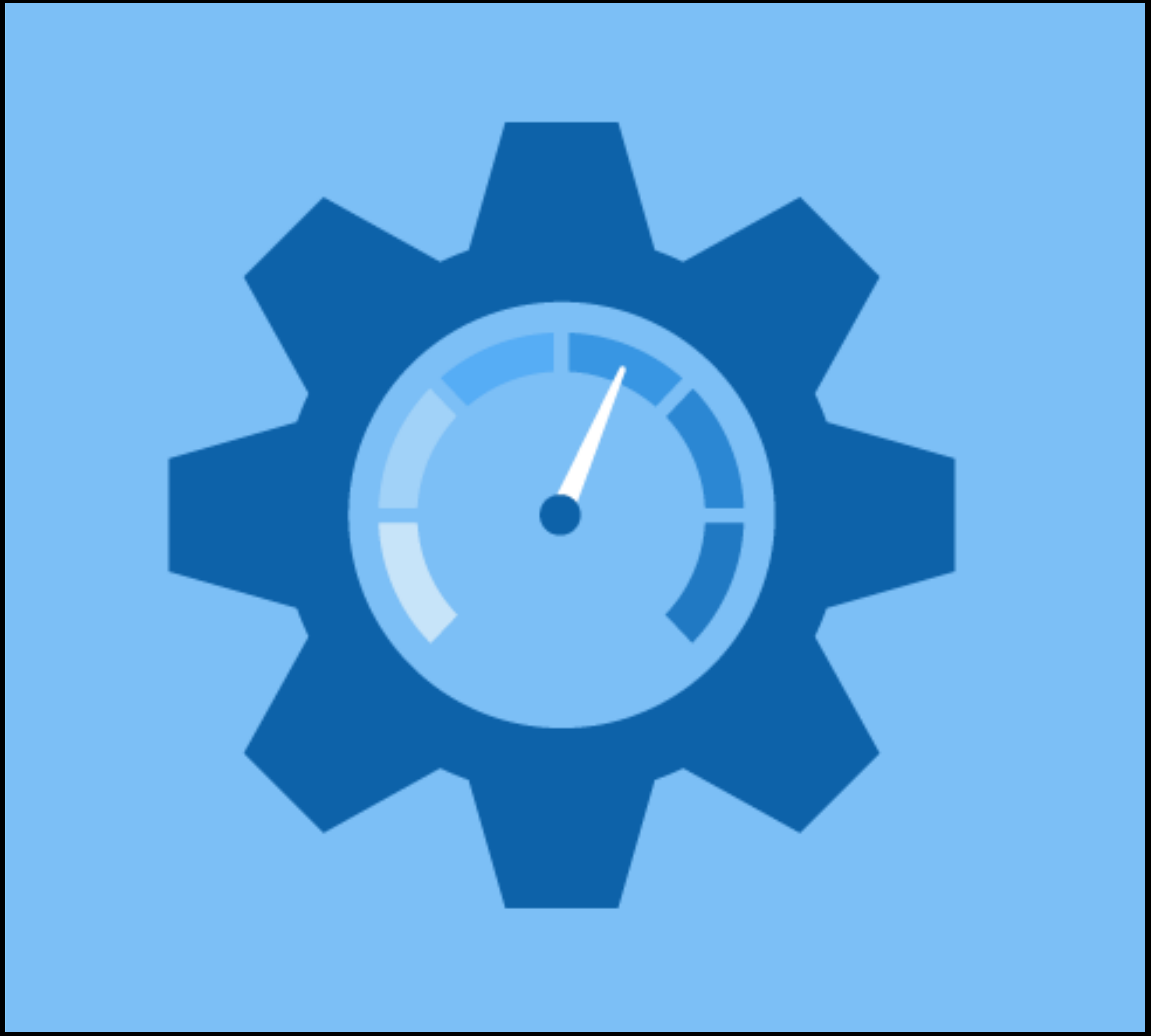
COMPILERS



BACKGROUND

OPTIMIZE

- Unroll Loops
- Remove dead code
- End-tail recursion



BACKGROUND

OPTIMIZE

- Unroll Loops
- Remove dead code
- End-tail recursion
- “Super” optimize

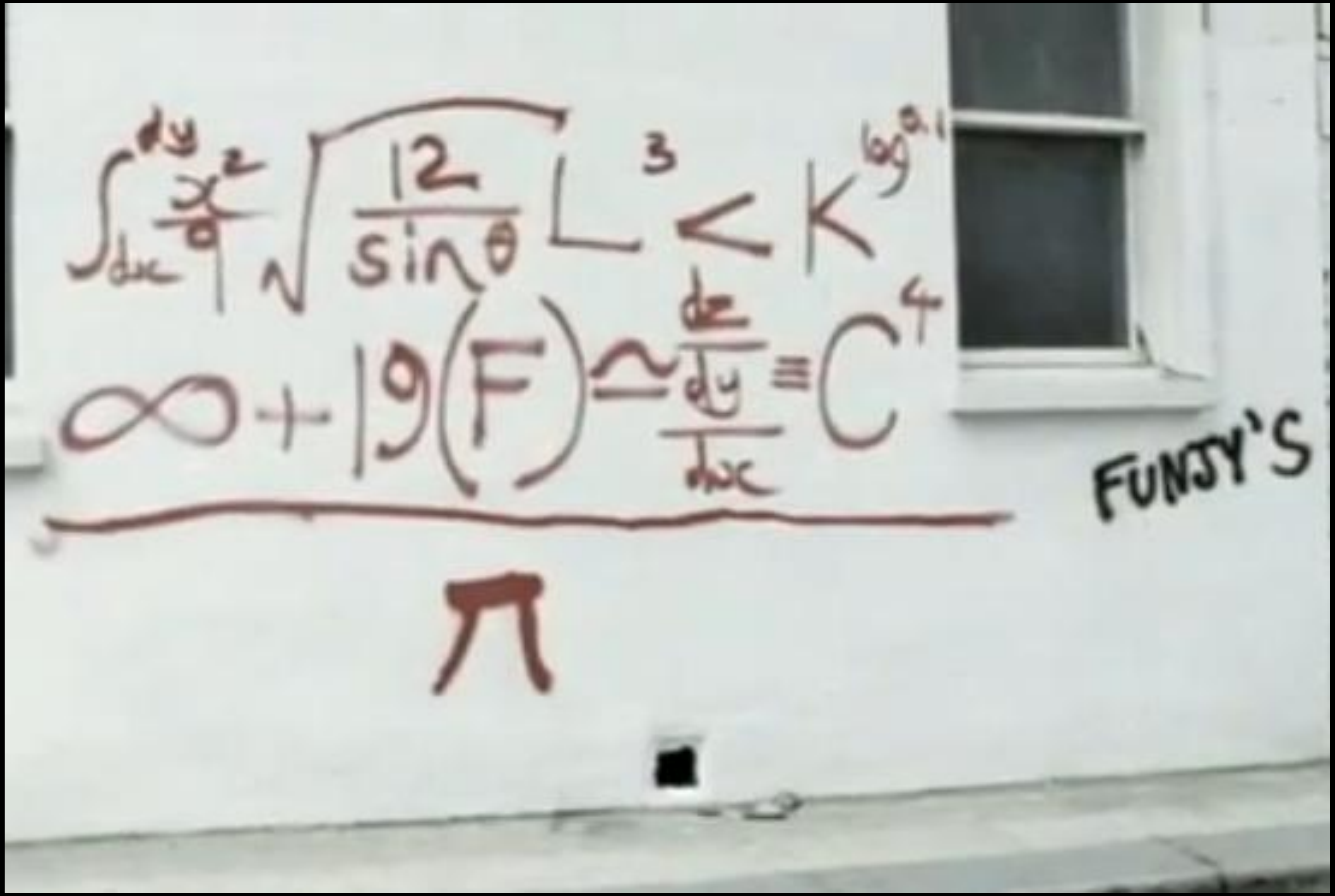
BACKGROUND

CONSTRAINTS

- Semantics
- Runtime
  - limited super optimization
- Composability
  - limits whole-program analysis
- Target Hardware
  - limited operations

CONSTRAINTS

- Math



PROVIDENCE, 2012

- Student Disappearances
- Abandoned Tunnel
- Basement of University Hall

PROVIDENCE, 2012

- Bricked up within building's walls
- Bound in human skin
- Aura of corruption
- Obscure and forbidding runes

by Sonka

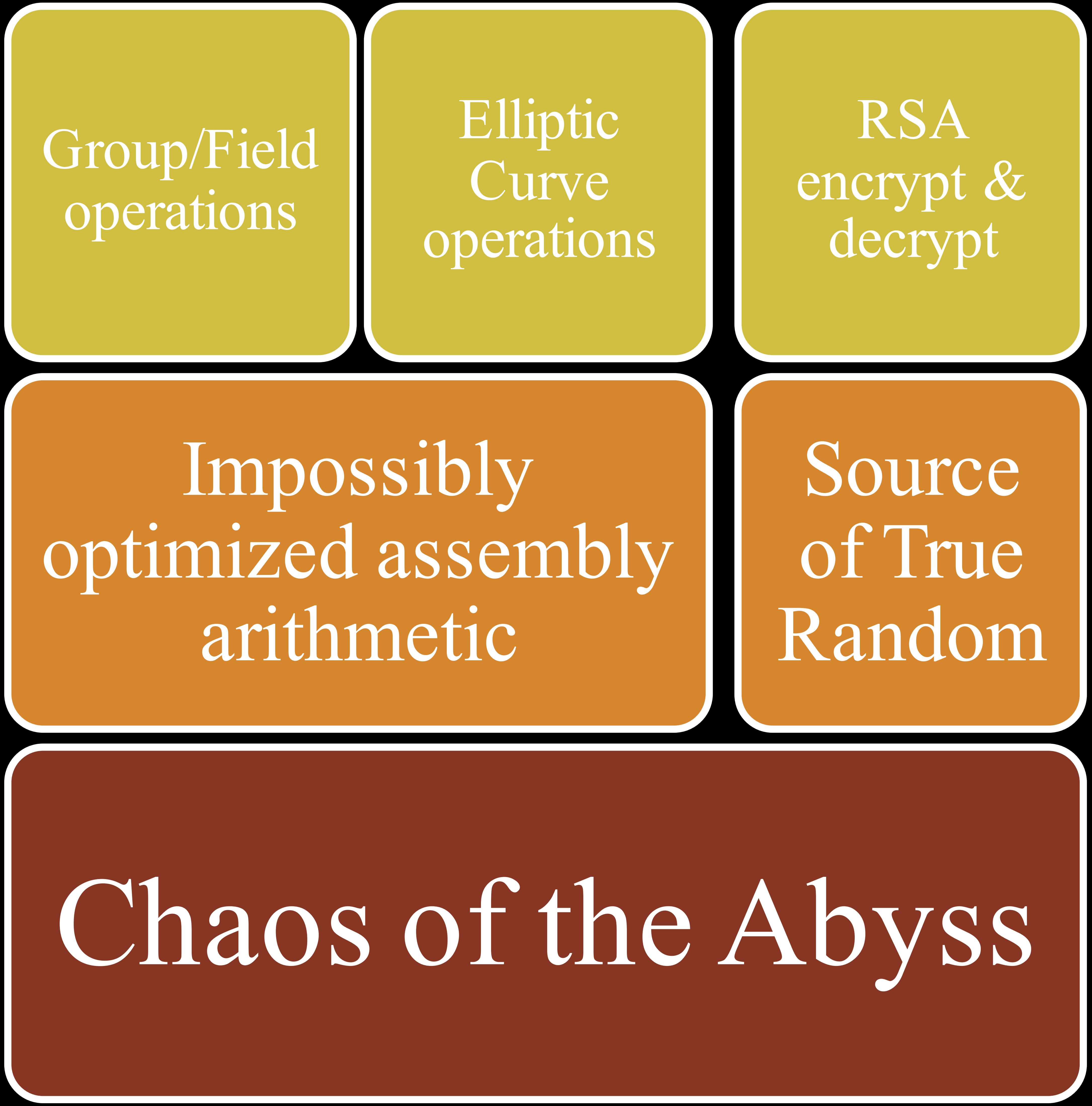
PROVIDENCE, 2012

- sacrifice the blood of the innocent for both efficiency and security
  - 3 human hearts
  - 2 pounds flesh
  - Extract of Nightshade
  - Aura of Pestilence
  - Stone carved with Elder Sign
  - Defiled altar of the Elder Gods
  - 1 goat

BACKGROUND

PROVIDENCE, 2012

- Edward Tremel, The Council of Shadows et al. – SigSEGV, 2014



Group/Field operations

Elliptic Curve operations

RSA encrypt & decrypt

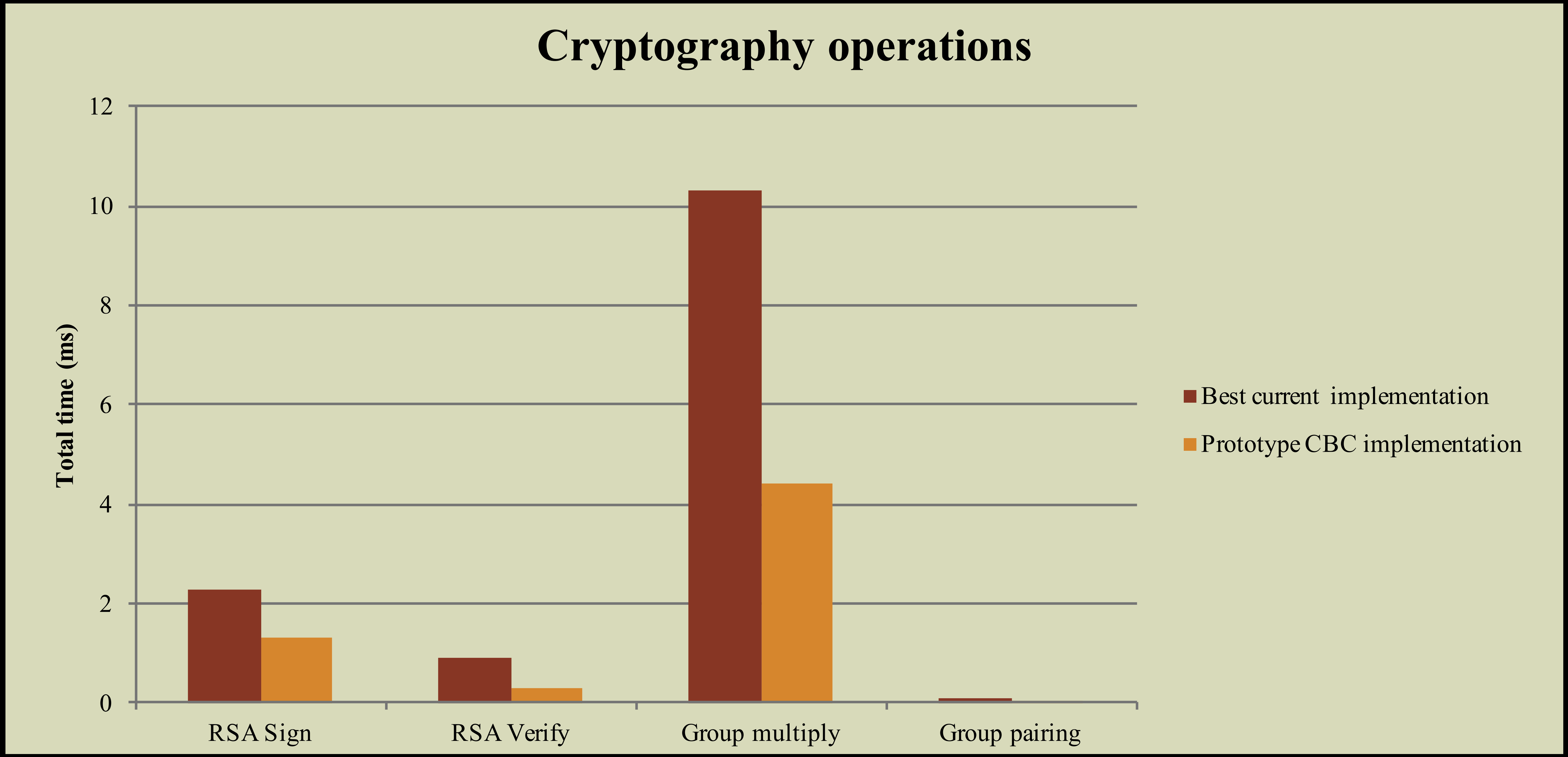
Impossibly optimized assembly arithmetic

Source of True Random

Chaos of the Abyss

PROVIDENCE, 2012

- Edward Tremel, The Council of Shadows et al. – SigSEGV, 2014



BACKGROUND

PROVIDENCE, 2012

- Edward Tremel, The Council of Shadows et al. – SigSEGV, 2014
  - “Tentacle Monster”
  - Channel to Abyss may not be as stable as originally thought
  - Chaos leaking into mortal plane
  - Increased incidence of unholy monstrosities in Providence area

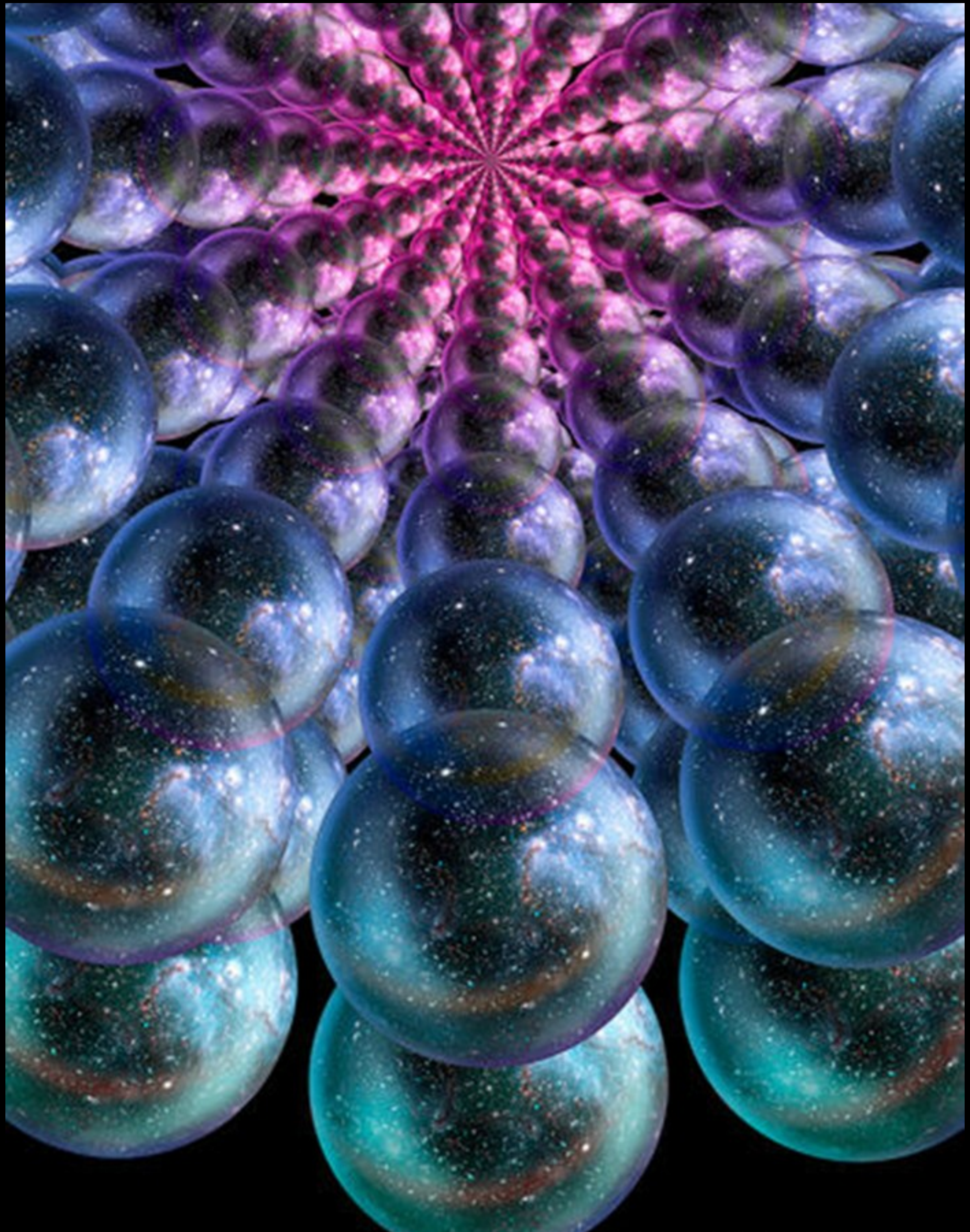
BACKGROUND

PROVIDENCE, 2012

OBJECTIVE

SAFE CROSS-PLANE OPTIMIZATION

- Infinite potential planes of existence
  - the quantums



OBJECTIVE

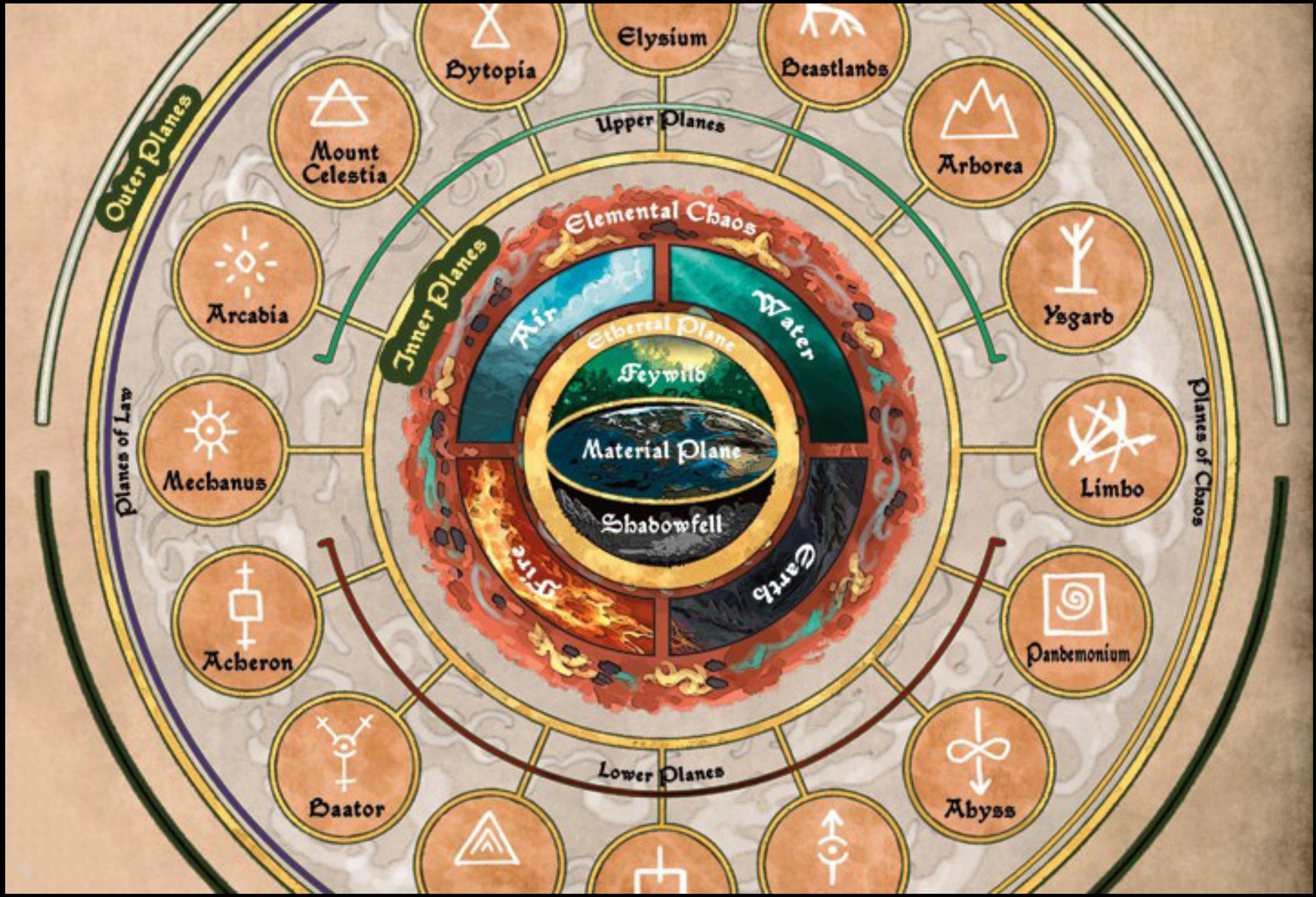
SAFE CROSS-PLANE OPTIMIZATION

- Infinite potential planes of existence
    - the quantums
- Ancient Theology

OBJECTIVE

SAFE CROSS-PLANE OPTIMIZATION

- Infinite potential planes of existence
  - the quantums
- Ancient Theology
- Modern Mapping Techniques



CONTRIBUTIONS

EQUIVALENT EXCHANGE

- To obtain, something of equal value must be lost

HUMANKIND CANNOT GAIN ANYTHING WITHOUT FIRST GIVING SOMETHING IN RETURN.
TO OBTAIN, SOMETHING OF EQUAL VALUE MUST BE LOST.
THAT IS ALCHEMY'S FIRST LAW OF EQUIVALENT EXCHANGE.

EQUIVALENT EXCHANGE

- To obtain, something of equal value must be lost
- Equality determined by “God”

CONTRIBUTIONS

EQUIVALENT EXCHANGE

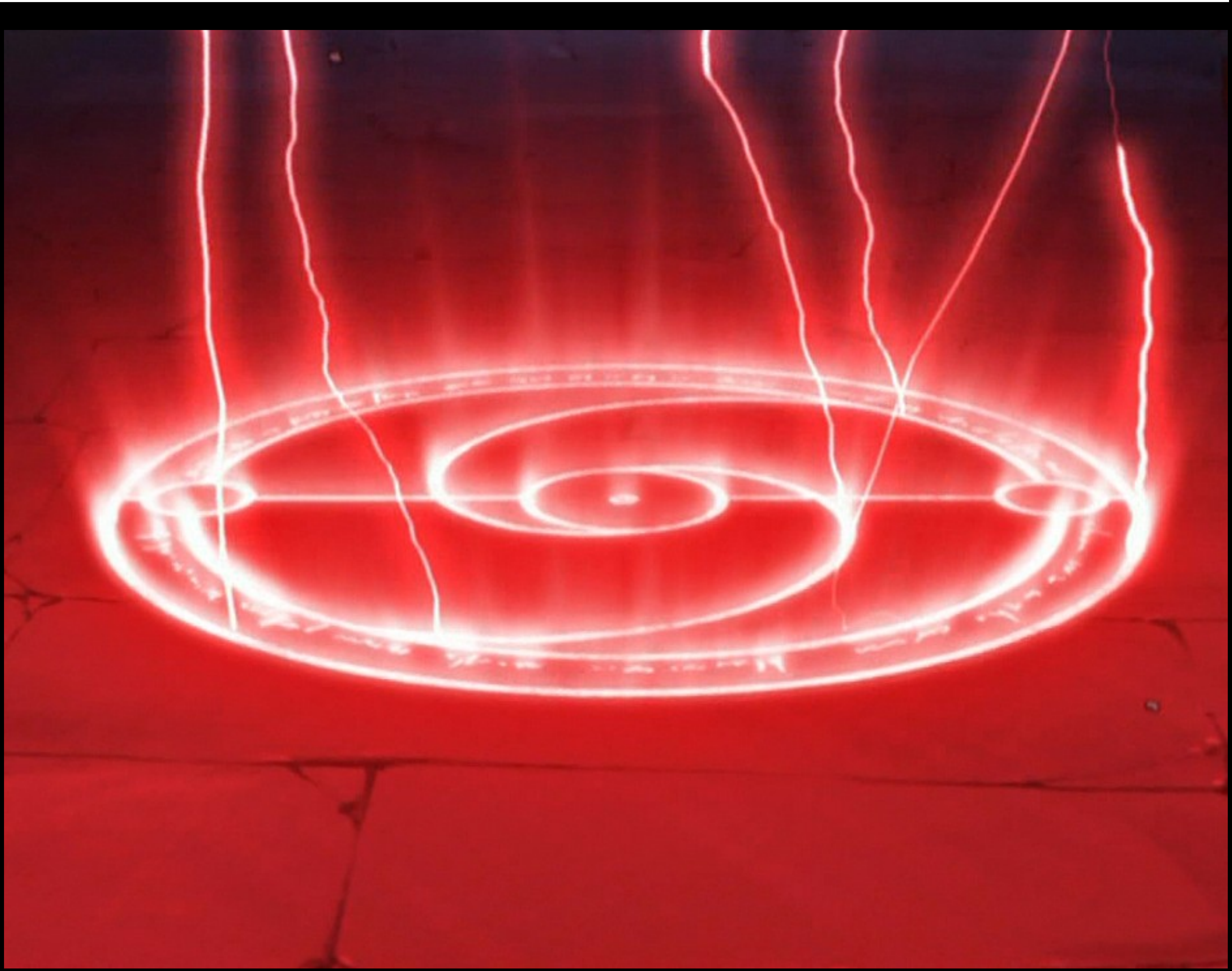
- To obtain, something of equal value must be lost
- Equality determined by “God”
- Constrains damage

TARGET LANGUAGE

- Alchemical symbols

TARGET LANGUAGE

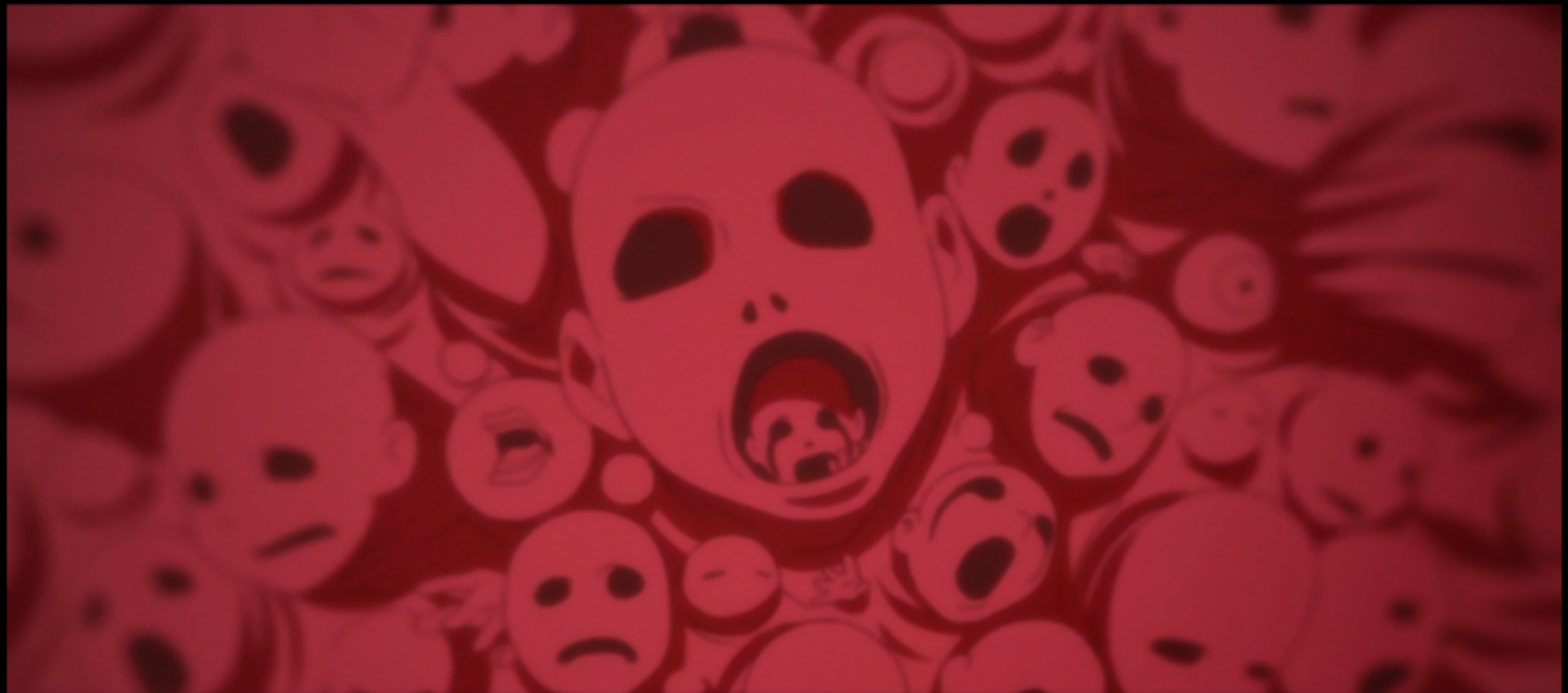
- Alchemical symbols
- Some degree of specialized hardware required



CONTRIBUTIONS

RUNTIME SACRIFICE

- Sacrifices range from 10 kJoules to 18,922 human souls
- Sacrifice value bounded **AT COMPILE TIME**



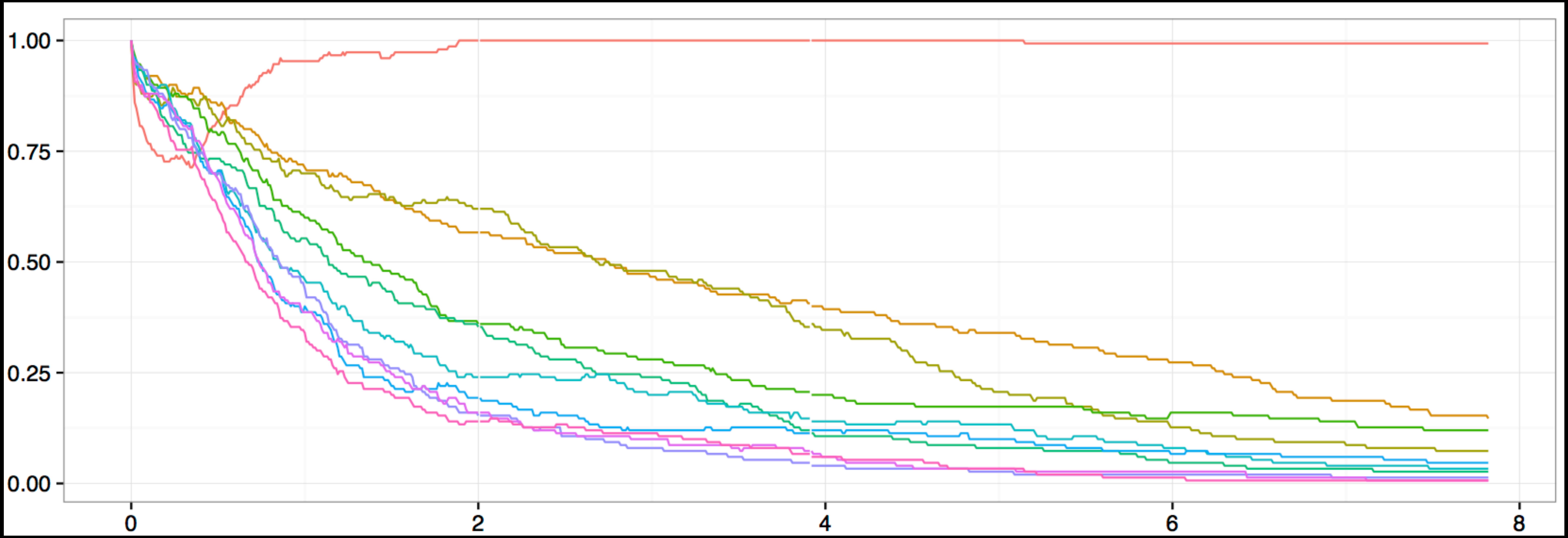
BLOODSTONE

- Type-safe compiler with compile-time bounded runtime sacrifice
- True whole-program super-optimization possible with compile-time sacrifice

RESULTS

BLOODSTONE

Performance
vs
Optimal



souls

CONTRIBUTIONS

FUTURE WORK

- High-value sacrifice
  - other than souls
- Decrease compile-time sacrifice