BEYOND OPTIMAL:
COMPILER BLACK MAGIC BASED ON EQUIVALENT EXCHANGE
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Asmodeus

“The Dwarf”
“the flask”
OPTIMIZE

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

CONSTRAINTS

- Math

\[ \int_{0}^{\infty} \frac{12}{\sin \theta} \sqrt{\int_{0}^{1} \frac{L^{3}}{V_{F}} \frac{\pi}{V_{F}} \frac{\pi}{V_{F}} = C} \]
BACKGROUND

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
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
PROVIDENCE, 2012

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

**BACKGROUND**

- Group/Field operations
- Elliptic Curve operations
- RSA encrypt & decrypt
- Impossibly optimized assembly arithmetic
- Source of True Random

**Chaos of the Abyss**
Edward Tremel, The Council of Shadows et al. – SigSEGV, 2014
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 quantum
- Ancient Theology
OBJECTIVE

SAFE CROSS-PLANE OPTIMIZATION

- Infinite potential planes of existence
  - the quantums
- Ancient Theology
- Modern Mapping Techniques
To obtain, something of equal value must be lost
CONTRIBUTIONS

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
CONTRIBUTIONS

TARGET LANGUAGE

- Alchemical symbols
CONTRIBUTIONS

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
CONTRIBUTIONS

BLOODSTONE

- Type-safe compiler with compile-time bounded runtime sacrifice
- True whole-program superoptimization possible with compile-time sacrifice
RESULTS

BLOODSTONE

Performance vs Optimal souls
CONTRIBUTIONS

FUTURE WORK

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