

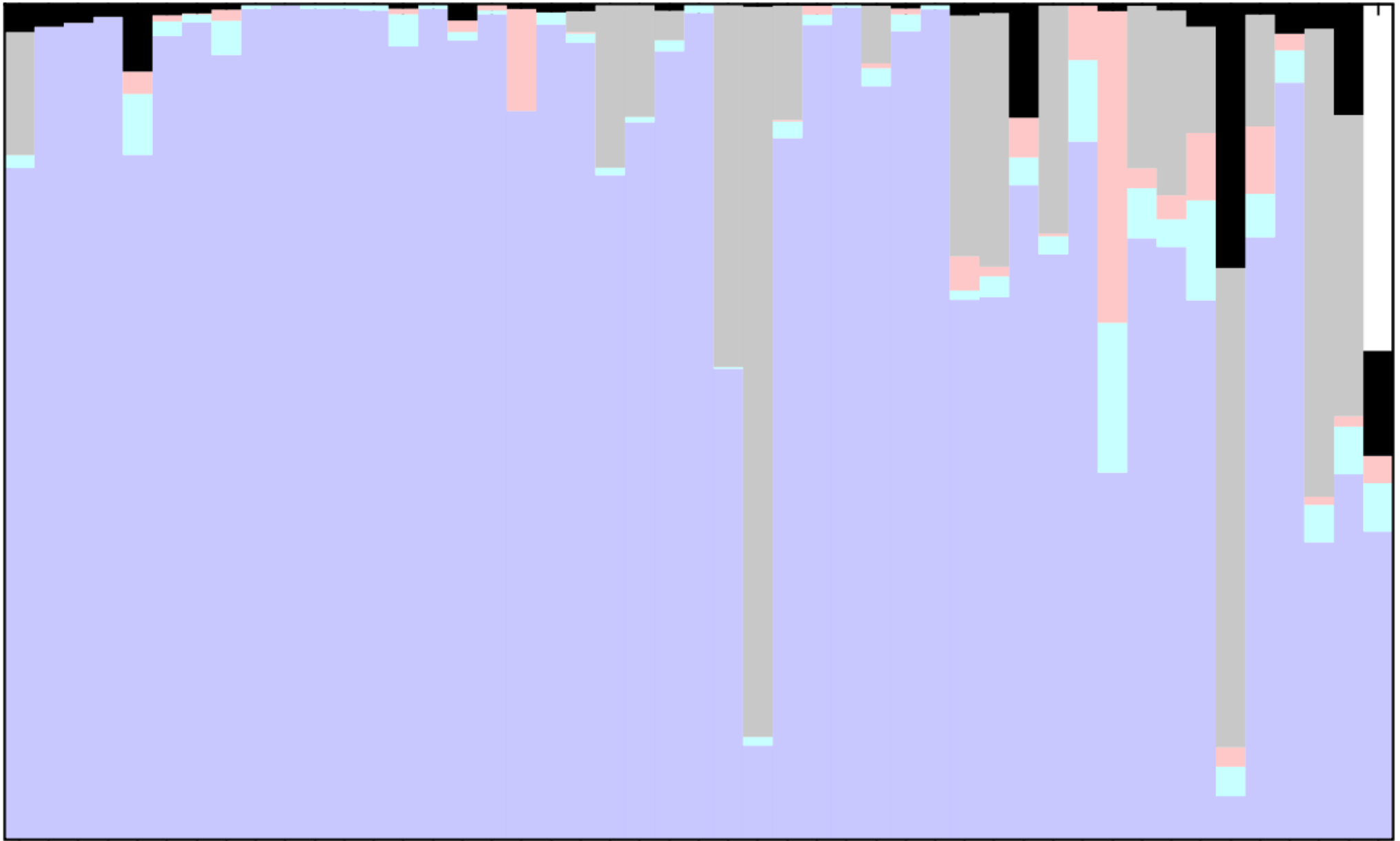
Doing It Once

Automatically Eliminating Redundant Work

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Programs Are Bad

- Recompute the same old stuff
 - In the same run
 - Between runs



0.2 0.4 0.6 0.8 1 1.2 1.4 1.6 1.8 2 2.2 2.4 2.6 2.8 3 3.2 3.4 3.6 3.8 4 4.2 4.4 4.6 4.8 5 5.2 5.4 5.6 5.8 6 6.2 6.4 6.6 6.8 7 7.2 7.4 7.6 7.8 8 8.2 8.4 8.6 8.8 9 9.2 9.4

B-self █ RK-self █ RU-self █ U-self █ others-others █

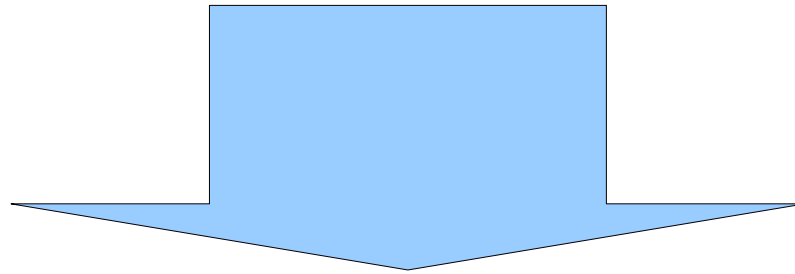
Programmers Are Bad

- Optimise until people stop complaining
- But... unanticipated situations?
 - Slow machines
 - Heavily loaded machines
 - Used embedded within another program

Compilers Are Good

- Automatic program improvement
- At no cost

```
x = arctan(y);  
z = sinh(w) + arctan(y);
```



```
t = arctan(y);  
x = t;  
z = sinh(w) + t;
```

Compilers Are Limited

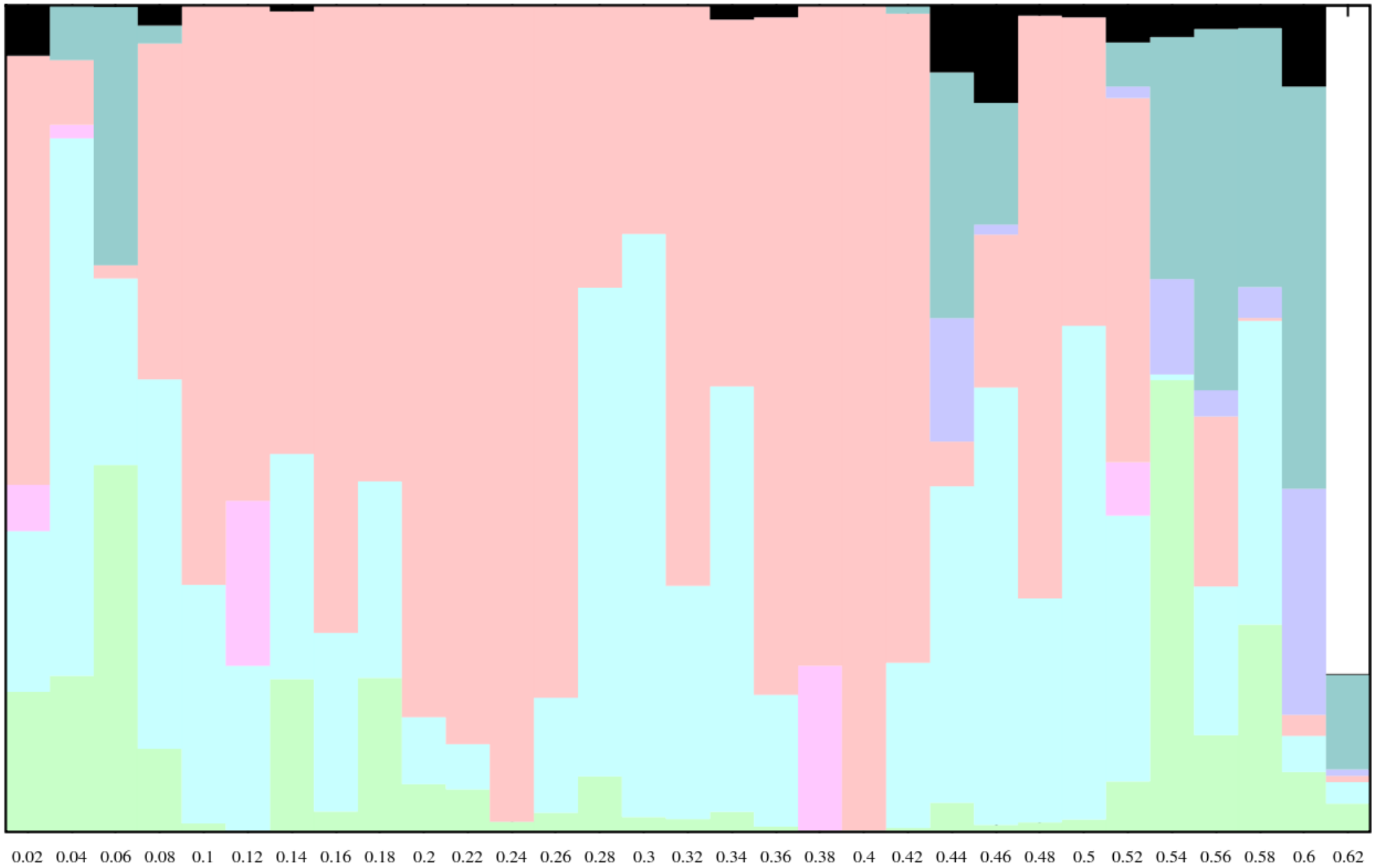
- Need the source
- Compile-time constants only
- Seldom use feedback
 - Better: LLVM

So: Let's Improve Binaries

- Remove redundant work:
 - Reading same file
 - As earlier in this run
 - As on previous runs
 - Predictable conversation with Xorg
 - Predictable thread interleaving (--> coroutines)

Haven't We Already Done That?

- Page cache
 - Eliminates much of FF's startup:



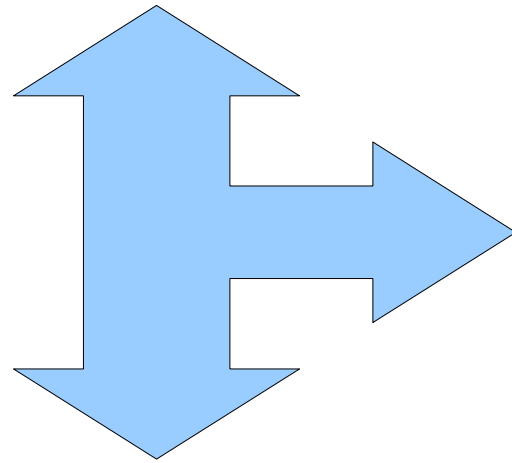
P-self █ RK-self █ RT-self █ RU-self █ B-Xorg:3277 █ RK-Xorg:3277 █ others-others █

What's to Gain?

- Long disk waits
 - Solved: page cache
- First time still slow (cold cache)
 - Solved: ReadyBoost, ureadahead
- Time spent parsing / building in-memory structs?
 - Snapshots?
 - Partial evaluation!

Partial Evaluation

$f(x, y)$



$f_dave(x)$

$y = \text{"dave"}$

Partial Evaluation

- Treat file contents as constants
- Propagate constants
- Inline functions
- Unroll loops
- --> Faster startup
- --> Faster at runtime
- --> Smaller binary
- `make firefox_config`

And More

- Specialise for common situations
- Specialise “cooperative” processes
 - Xorg, gconf
- Informed speculation

Questions?