Lecture 12: Validation

Talen en Compilers 2024-2025, period 2

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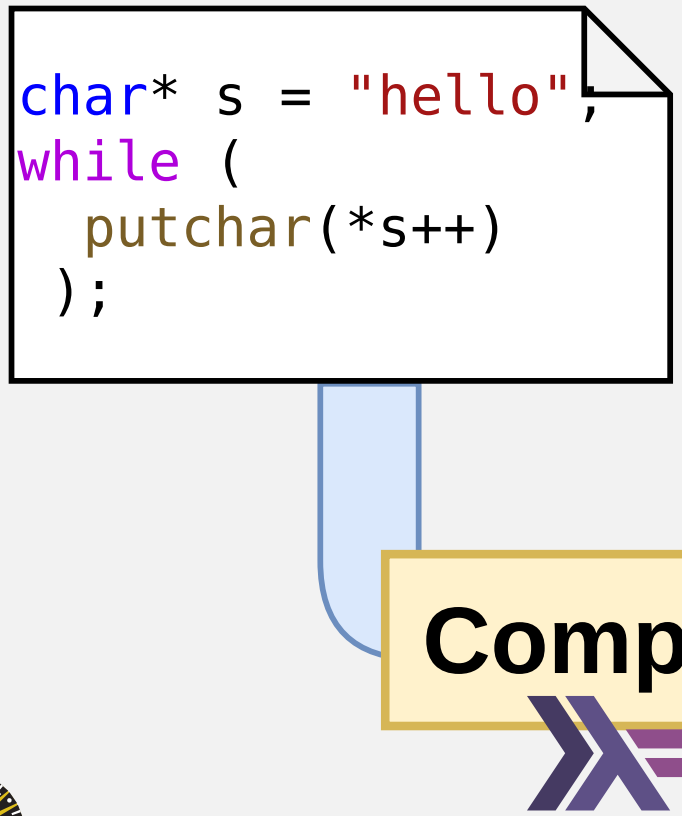
Compilers

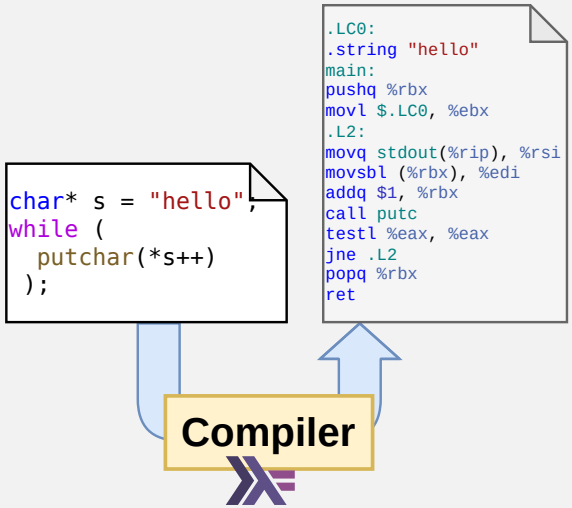
```
char* s = "hello";
while (
  putchar(*s++)
 );
```




```
.LC0:
.string "hello"
main:
pushq %rbx
movl $.LC0, %ebx
.L2:
movq stdout(%rip), %rsi
movsbl (%rbx), %edi
addq $1, %rbx
call putc
testl %eax, %eax
jne .L2
popq %rbx
ret
```

Human Error

Programmer Error



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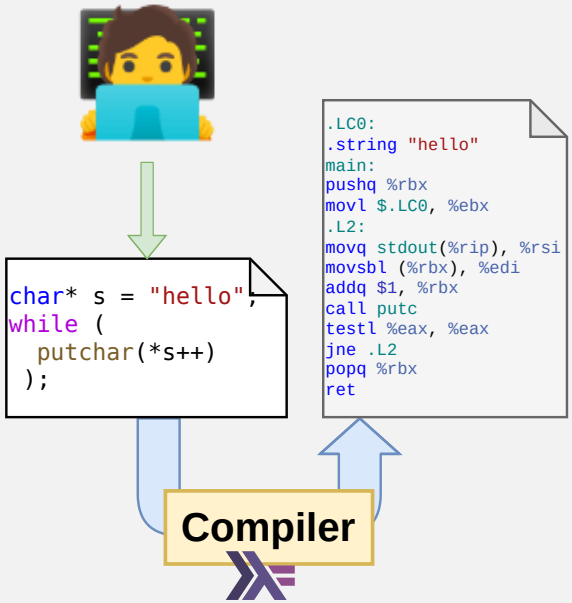

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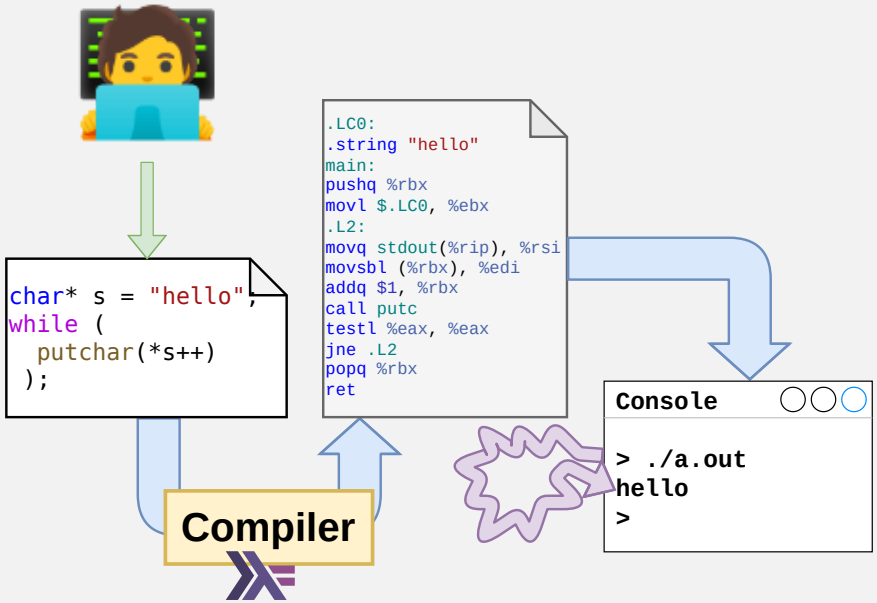

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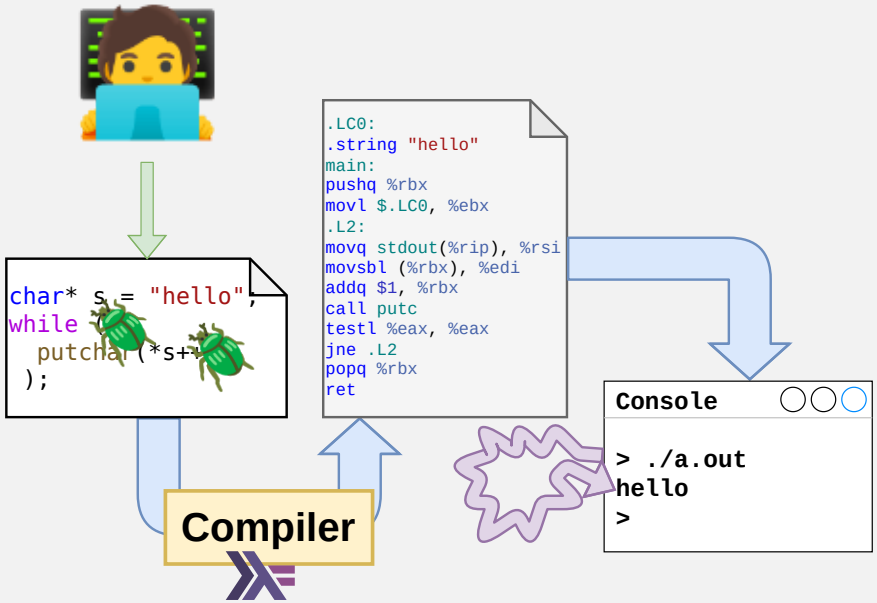

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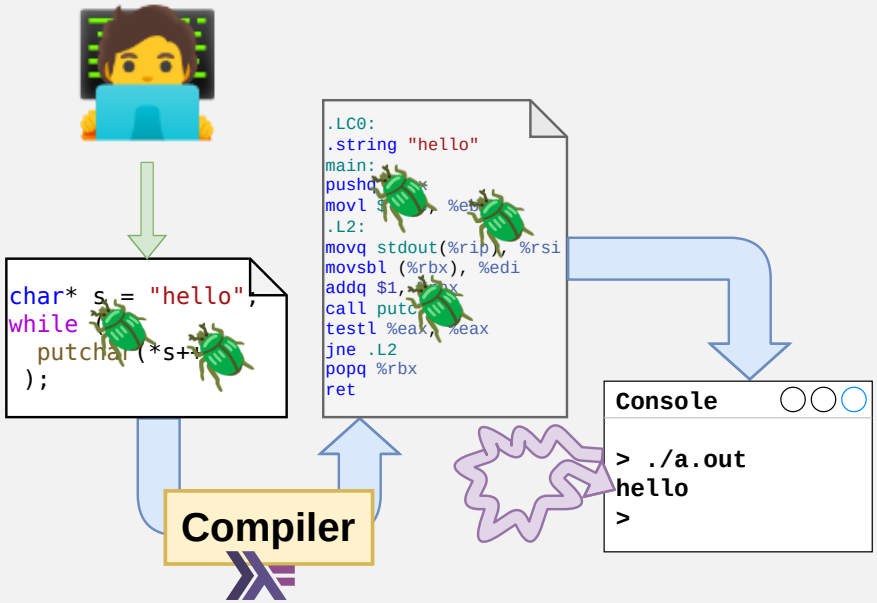

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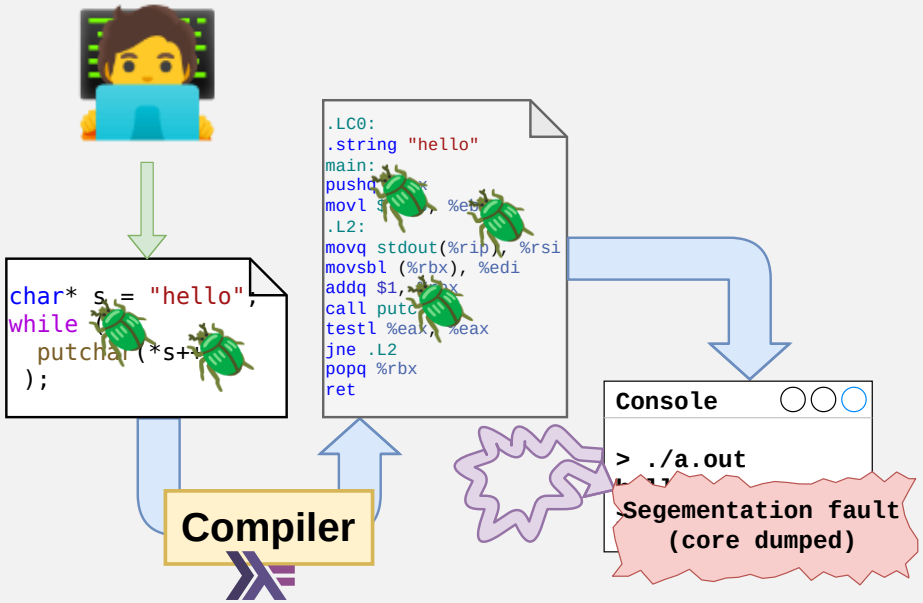

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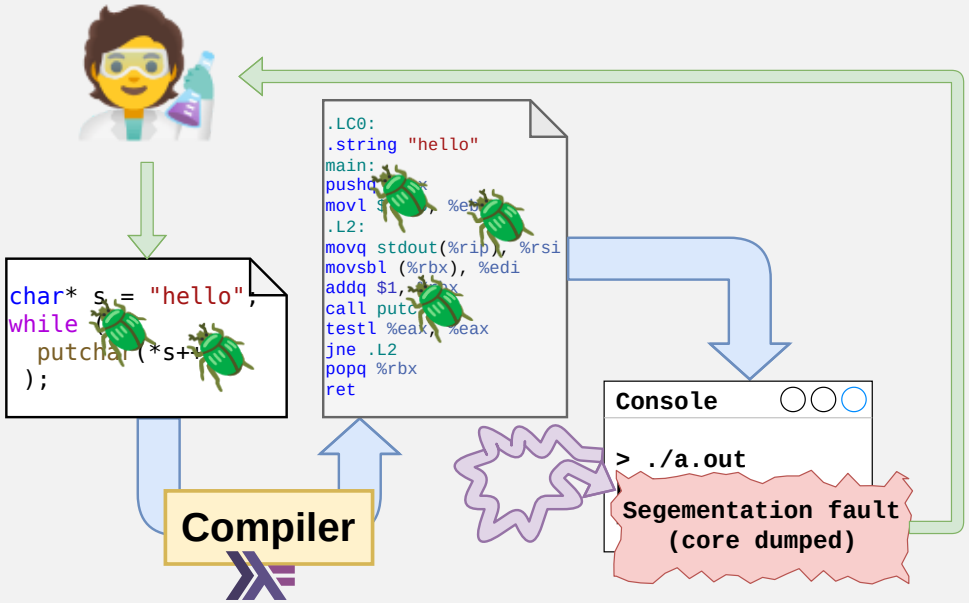

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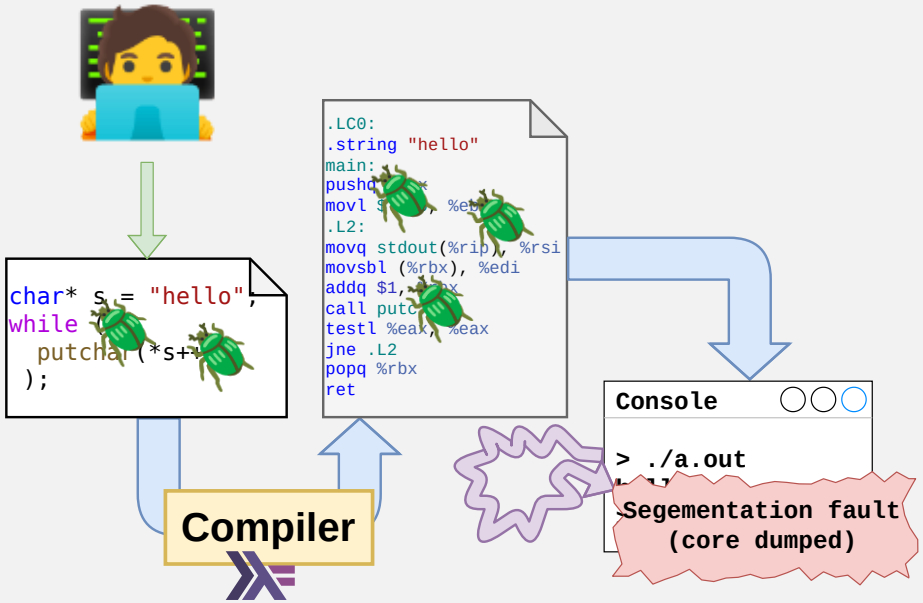

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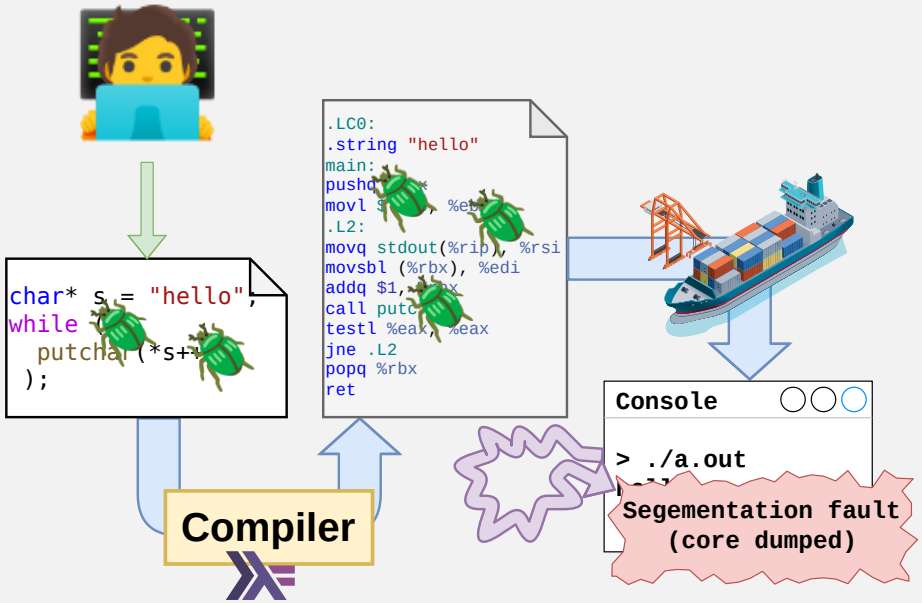

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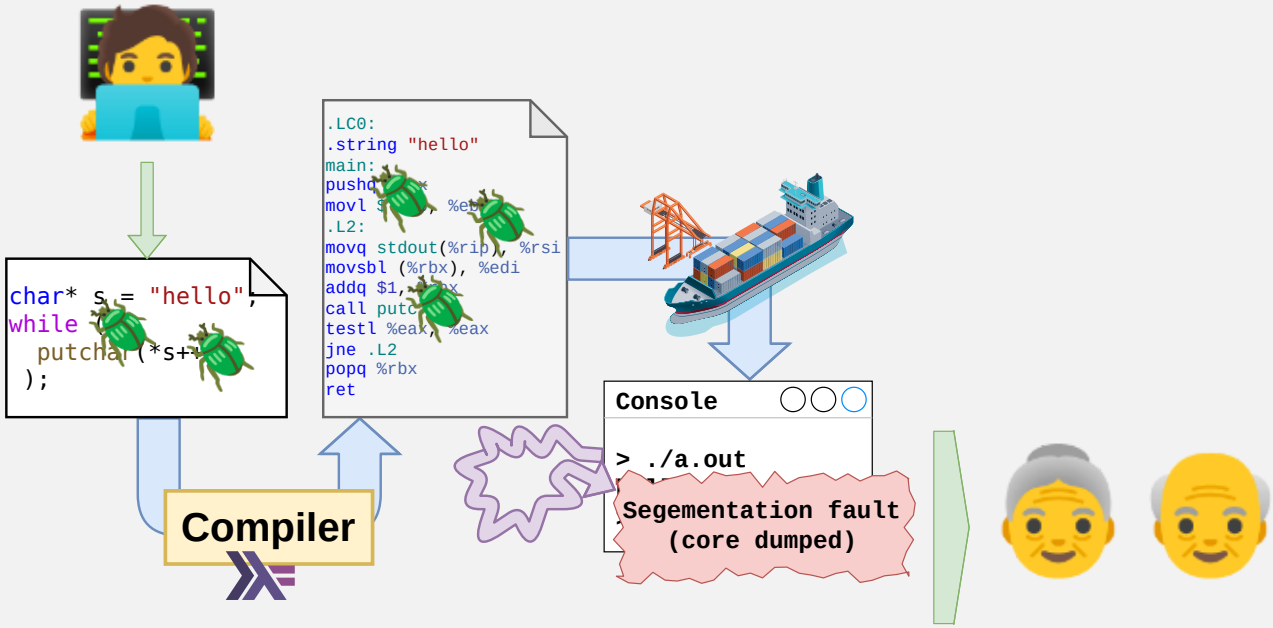
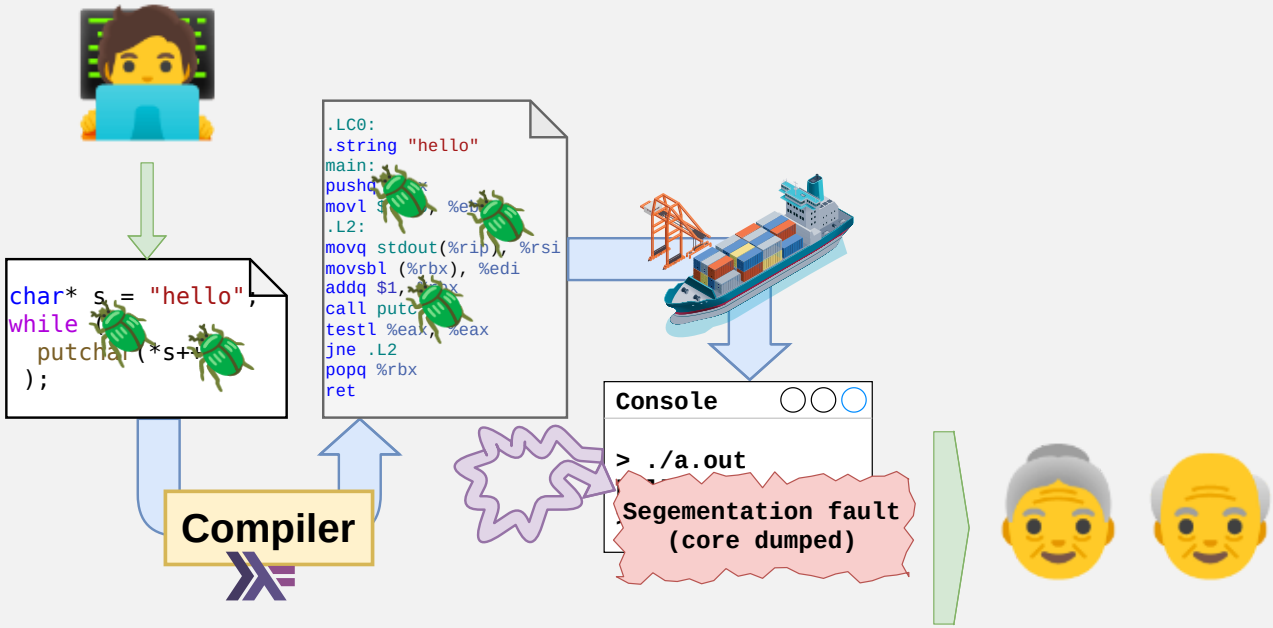
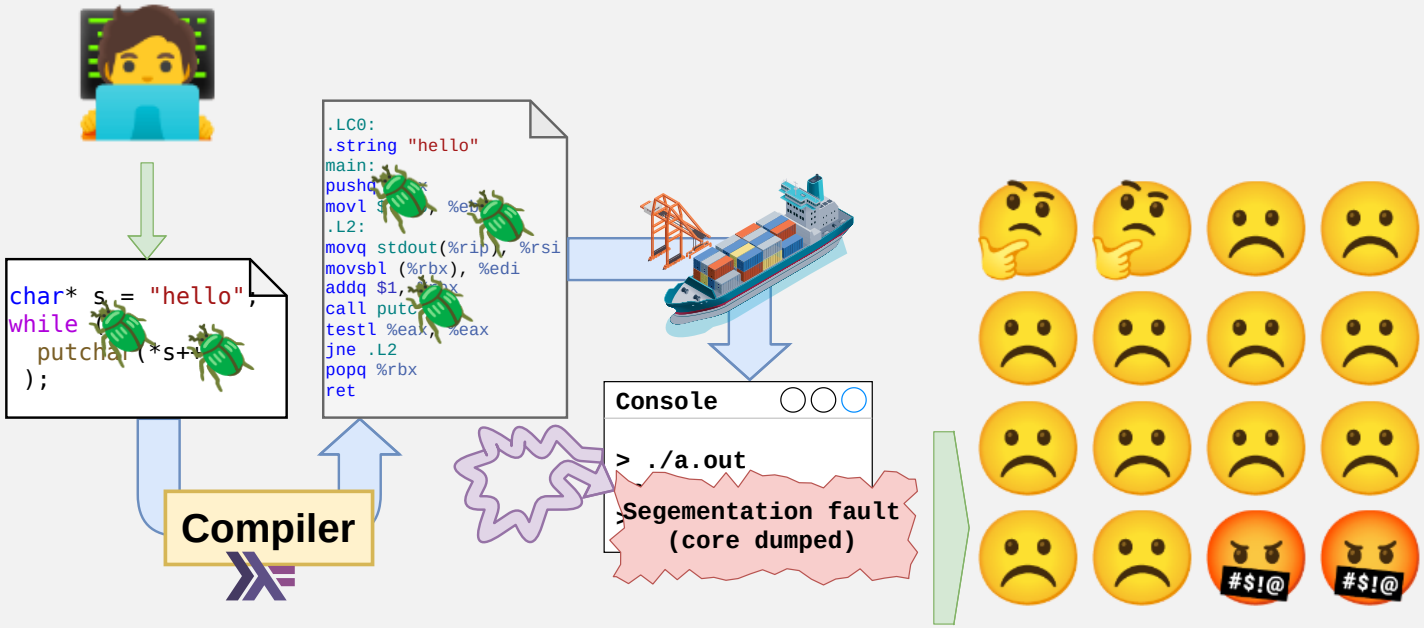


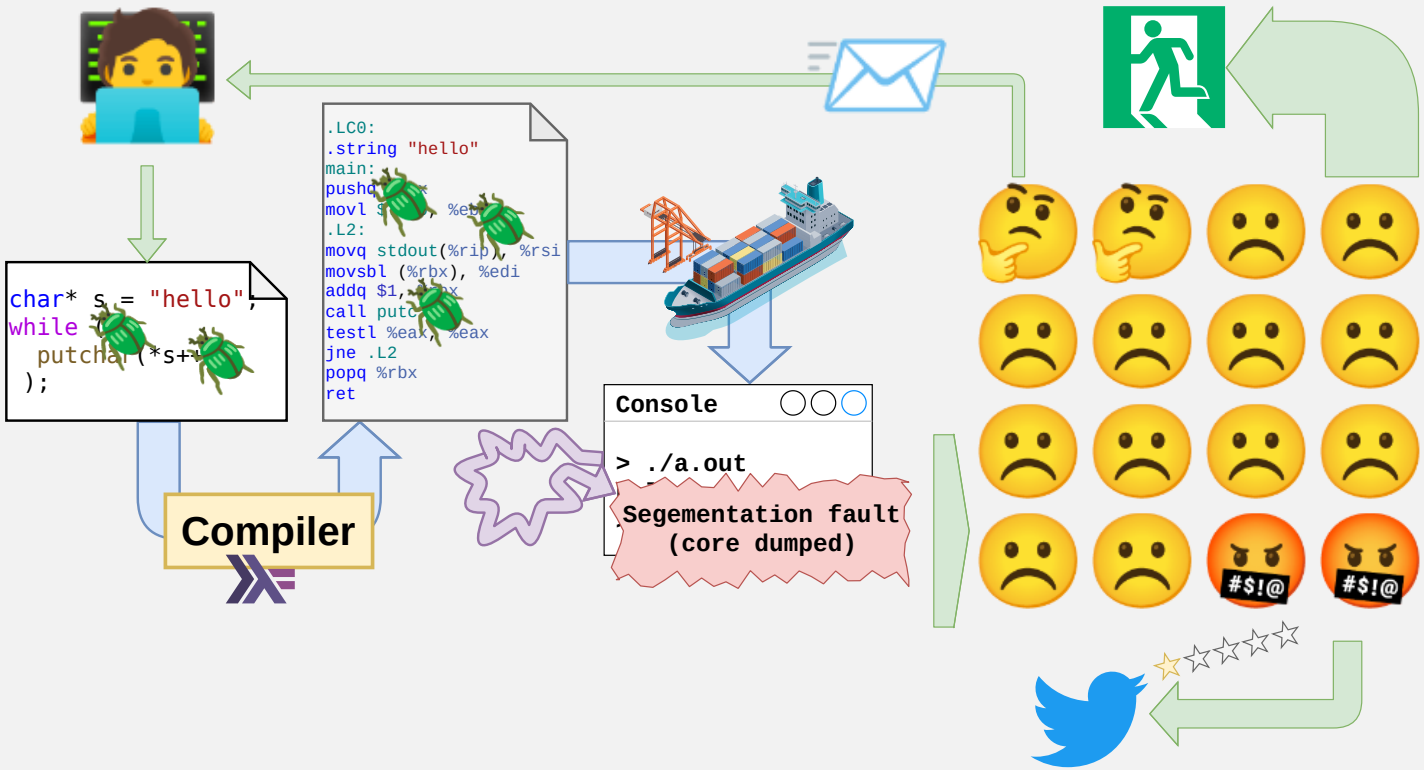
Consequences



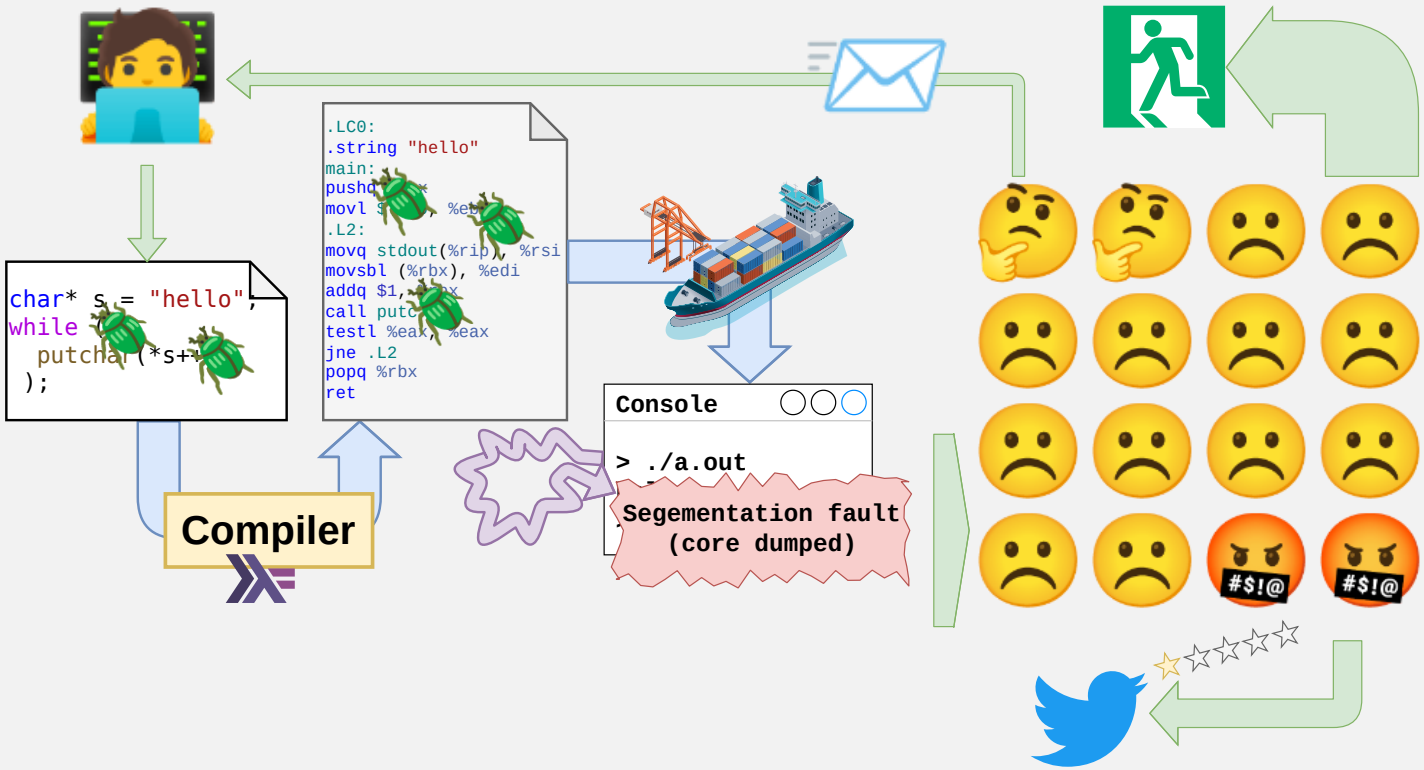
Consequences



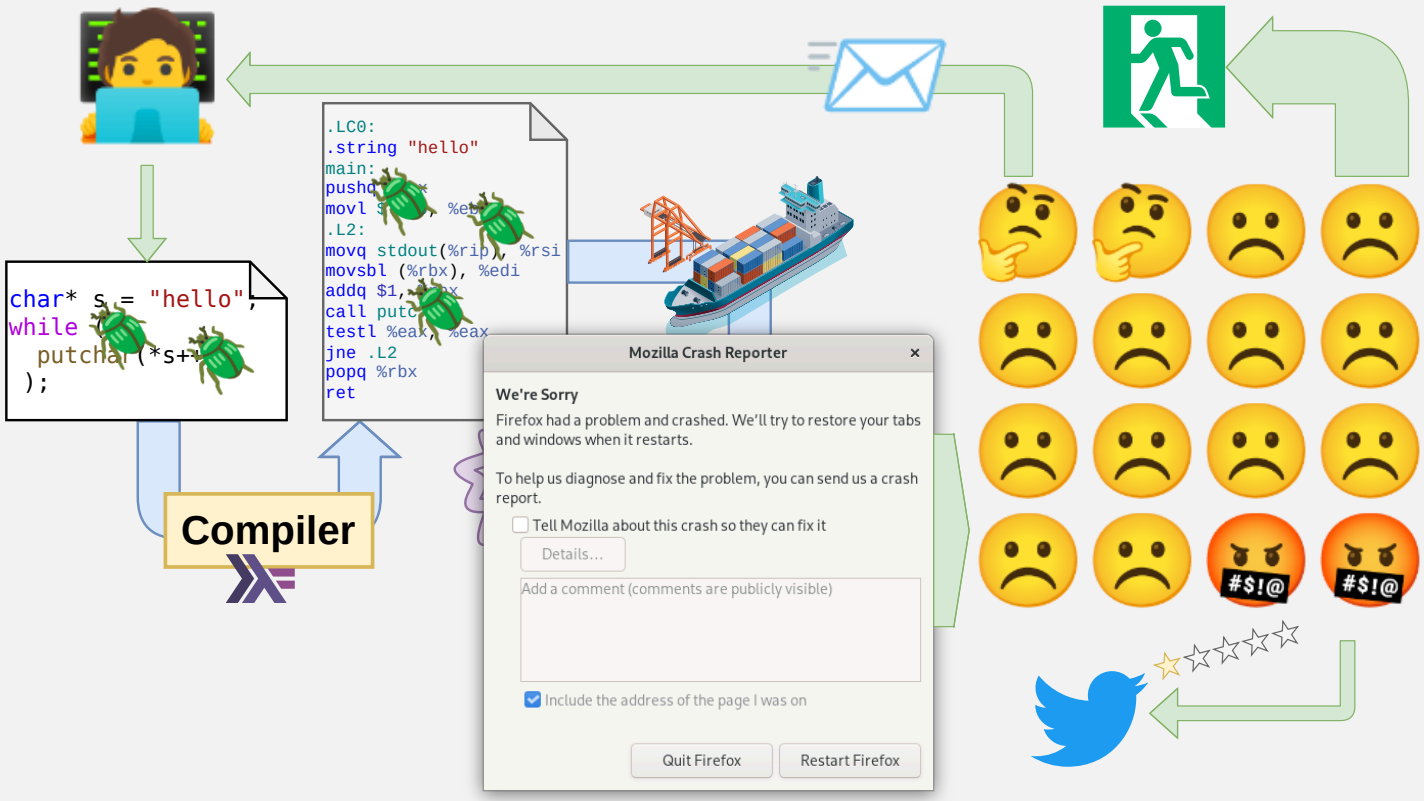
Consequences



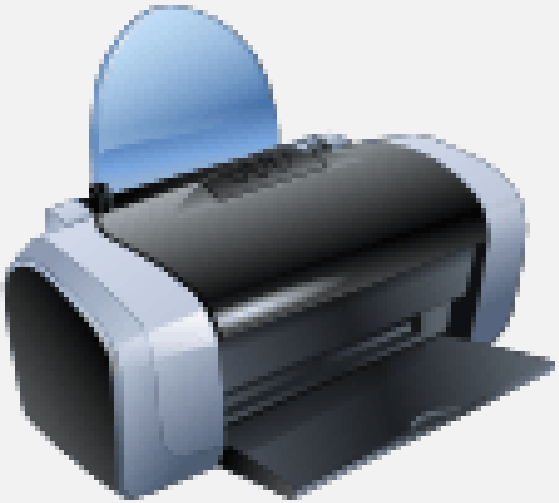
Error Message Quality

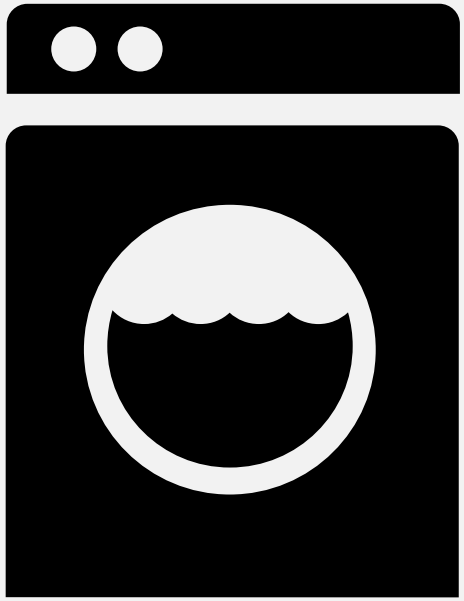


Error Message Quality



Error Messages aren't always enough





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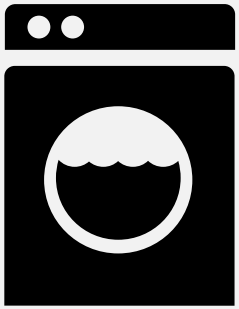

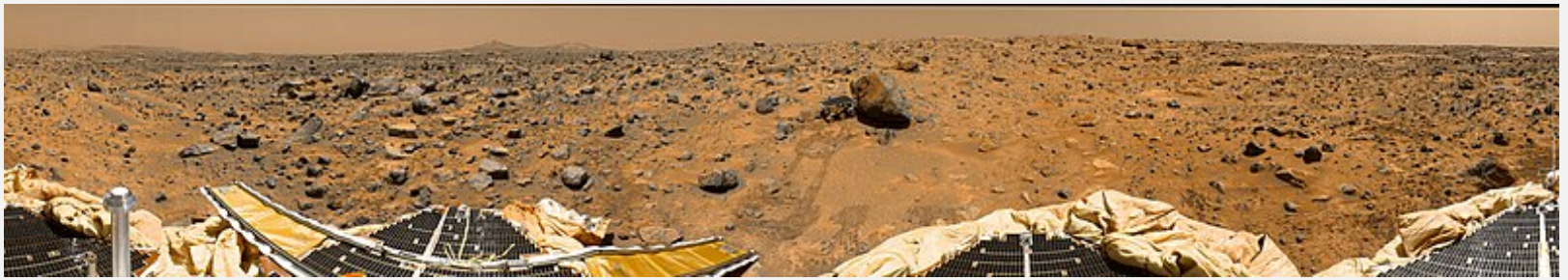

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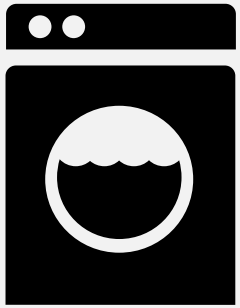

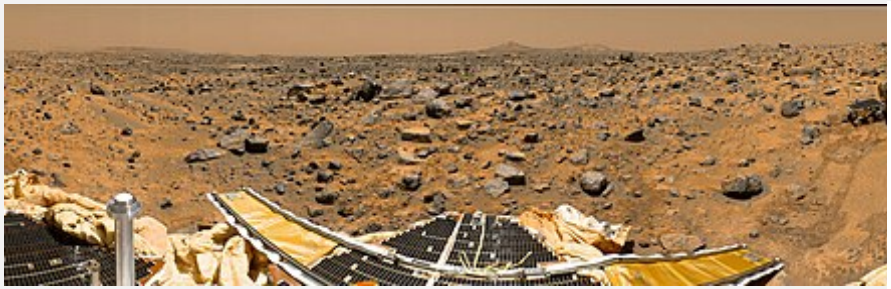

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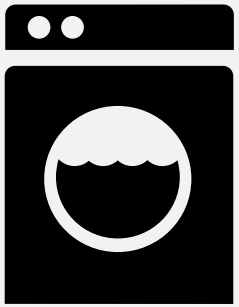
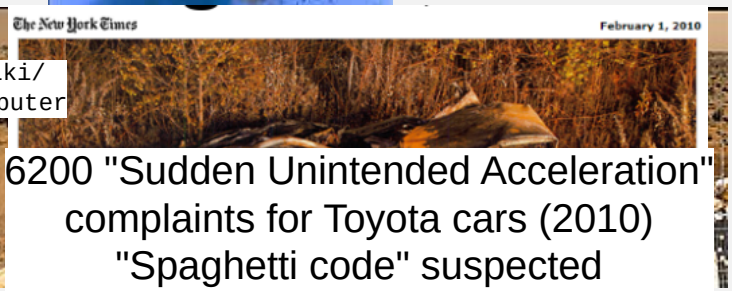


Ariane V88 self-destructs after failed float64 -> int16 conversion (1996)

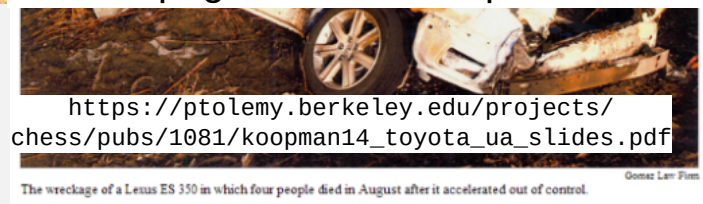
`http://www.capcomespace.net/dossiers/espace_europeen/ariane/ariane5/AR501/V88_AR501.htm`

Pathfinder Mars Lander goes to sleep after priority inversion (1997)

`https://en.wikipedia.org/wiki/Mars_Pathfinder#On-board_computer`



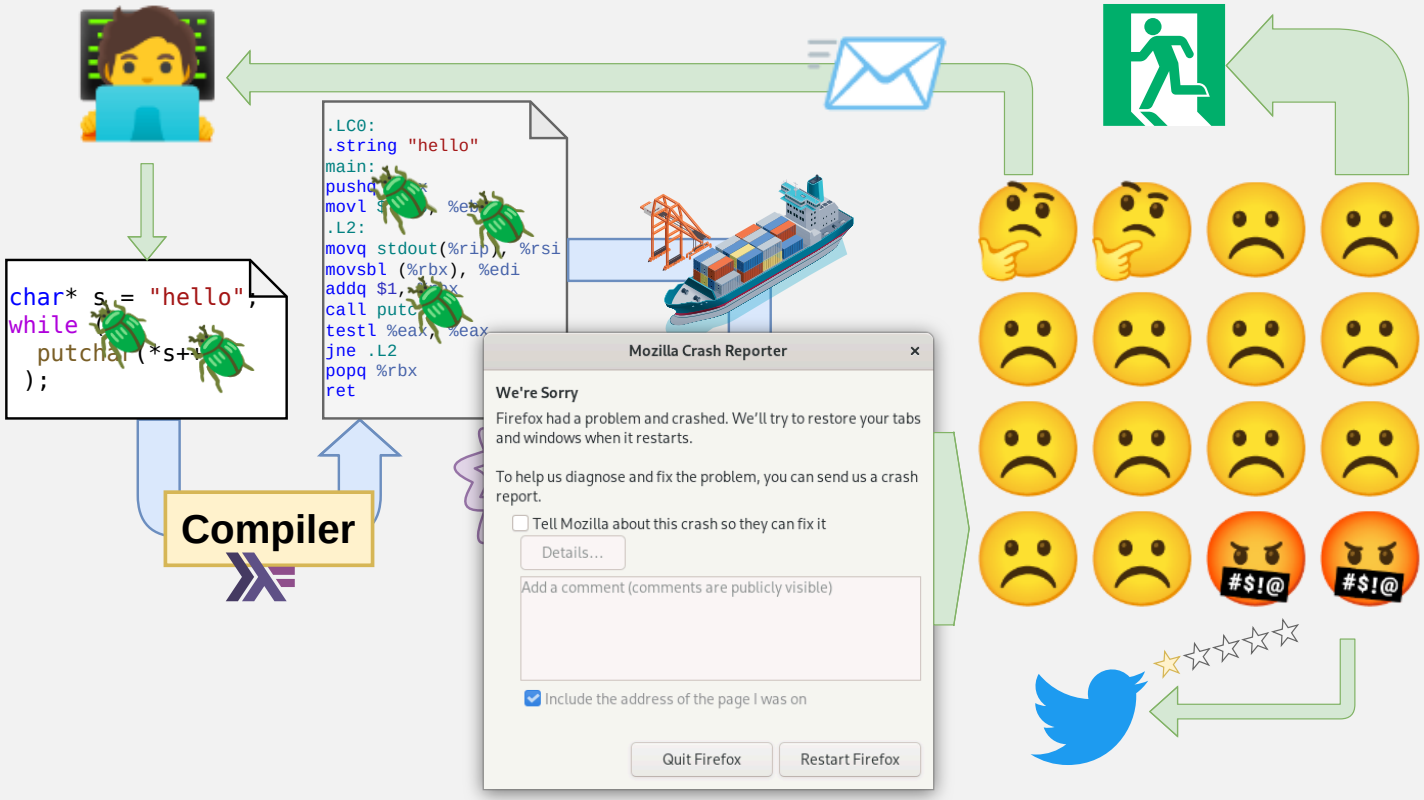
6200 "Sudden Unintended Acceleration" complaints for Toyota cars (2010)
"Spaghetti code" suspected



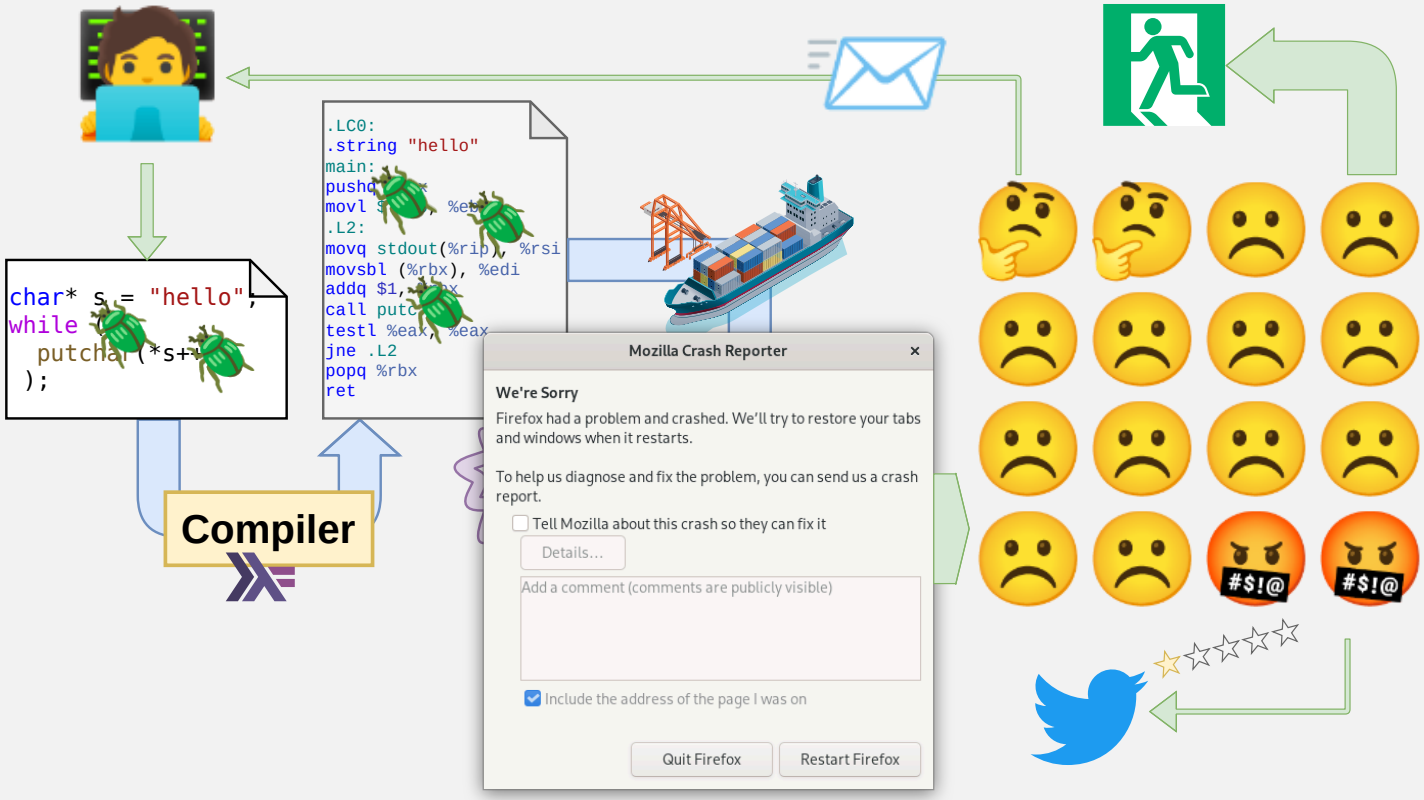
`https://ptolemy.berkeley.edu/projects/chess/pubs/1081/koopman14_toyota_ua_slides.pdf`

The wreckage of a Lexus ES 350 in which four people died in August after it accelerated out of control.

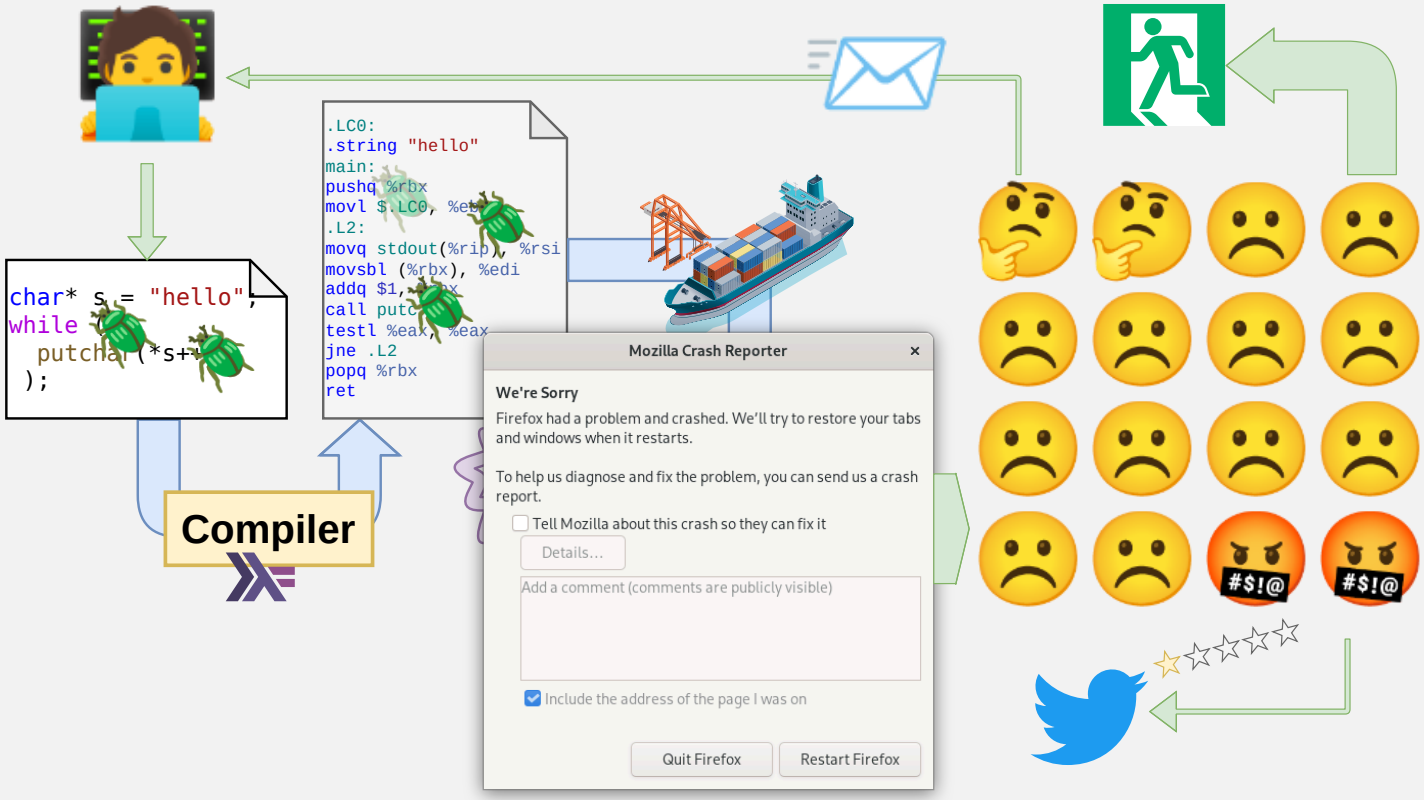
Fewer Errors



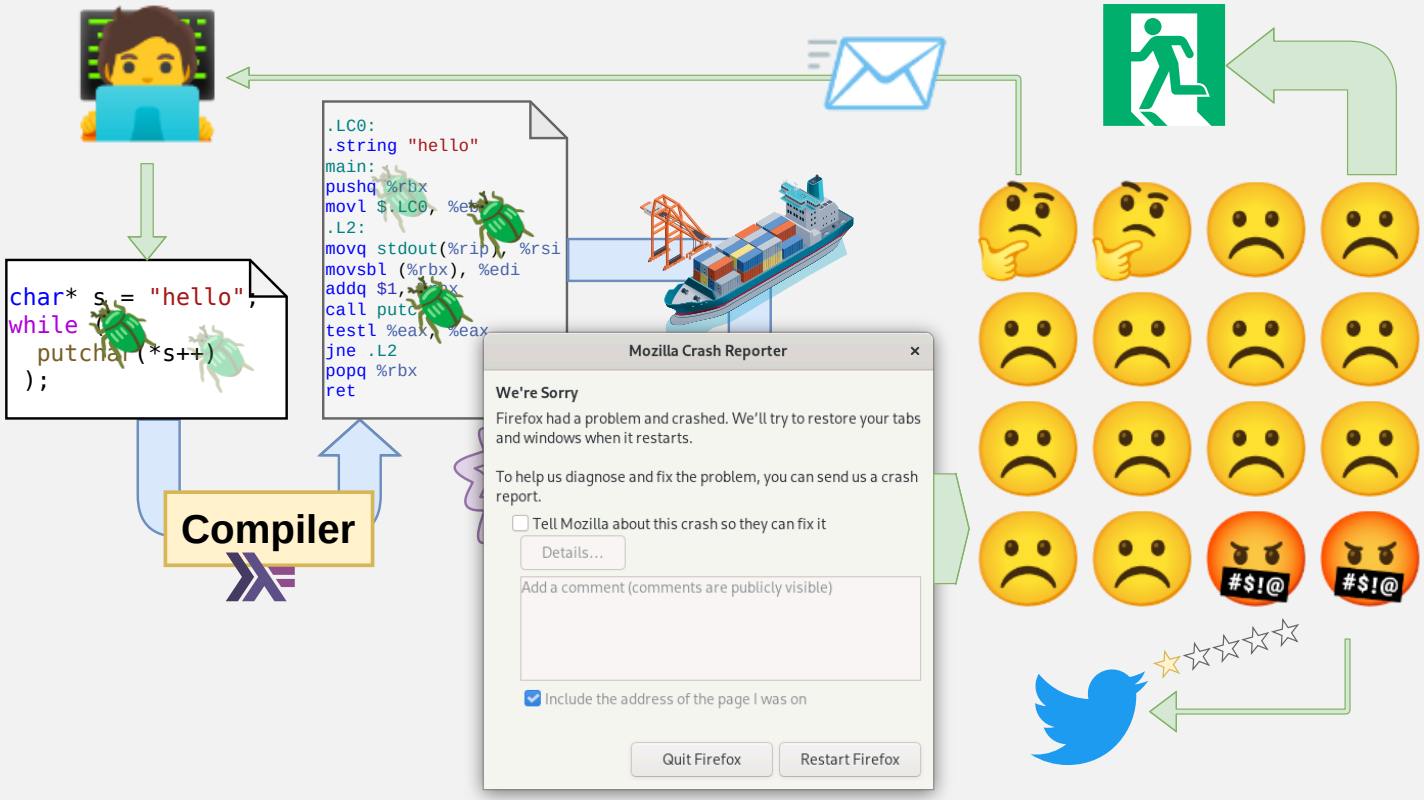
Fewer Errors



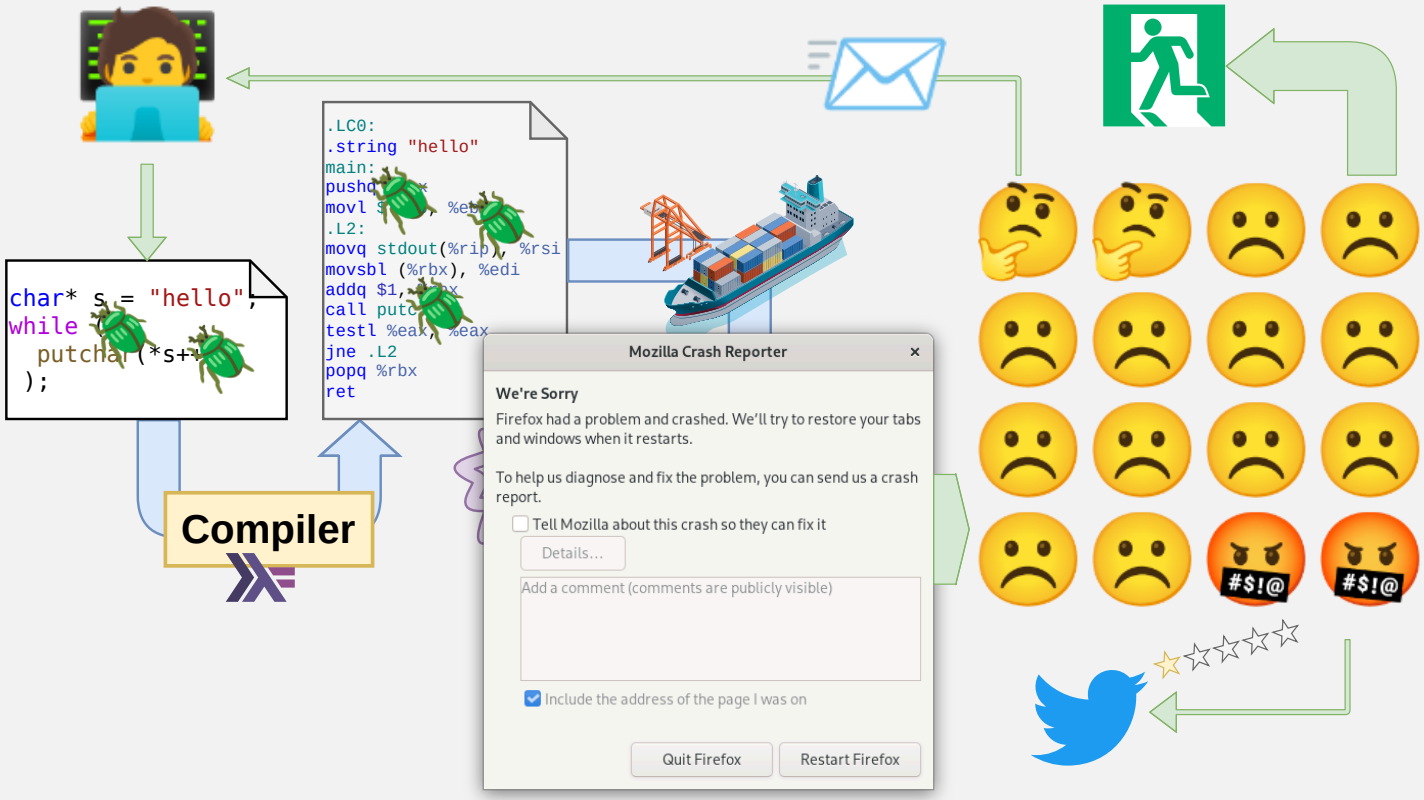
Fewer Errors



Fewer Errors



Where to hunt for



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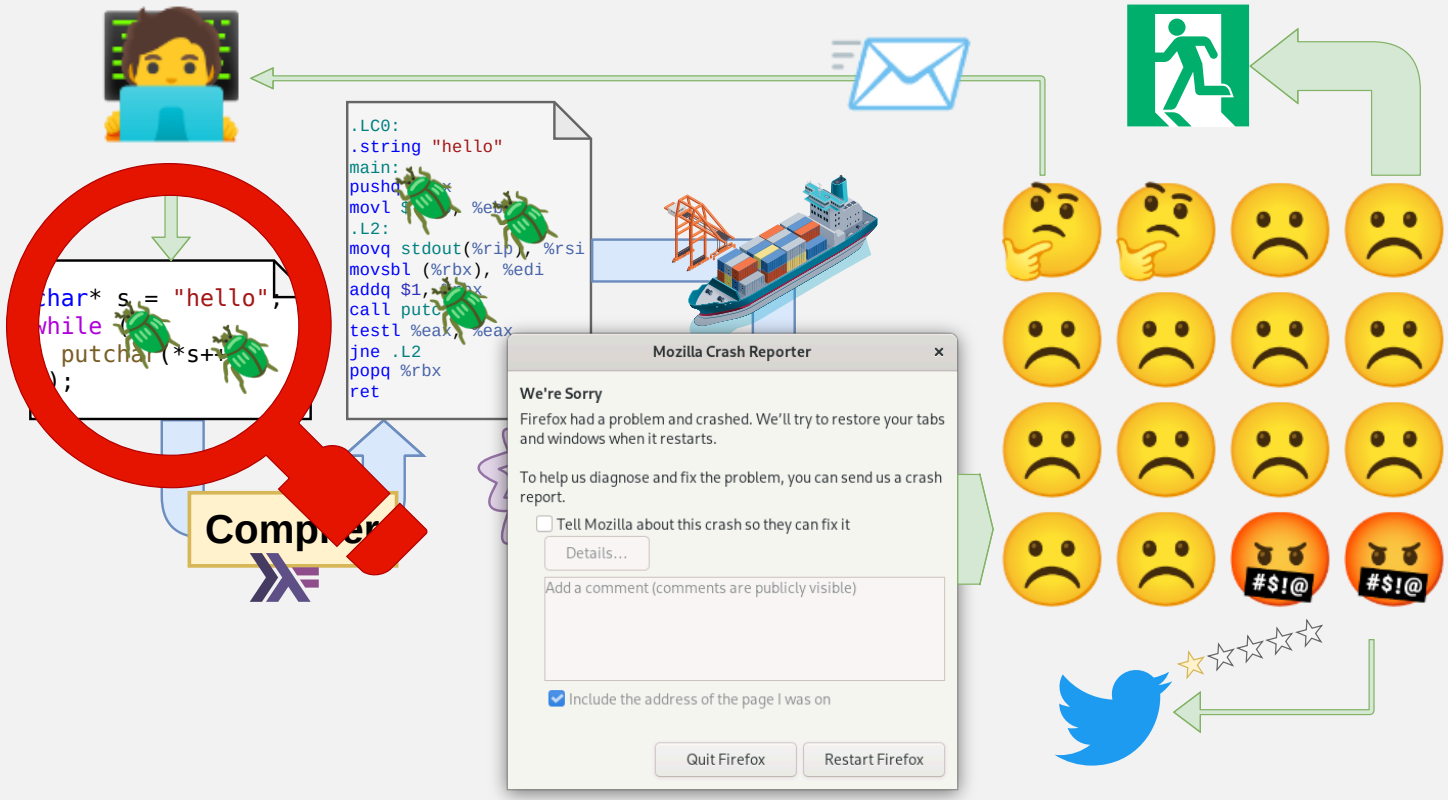

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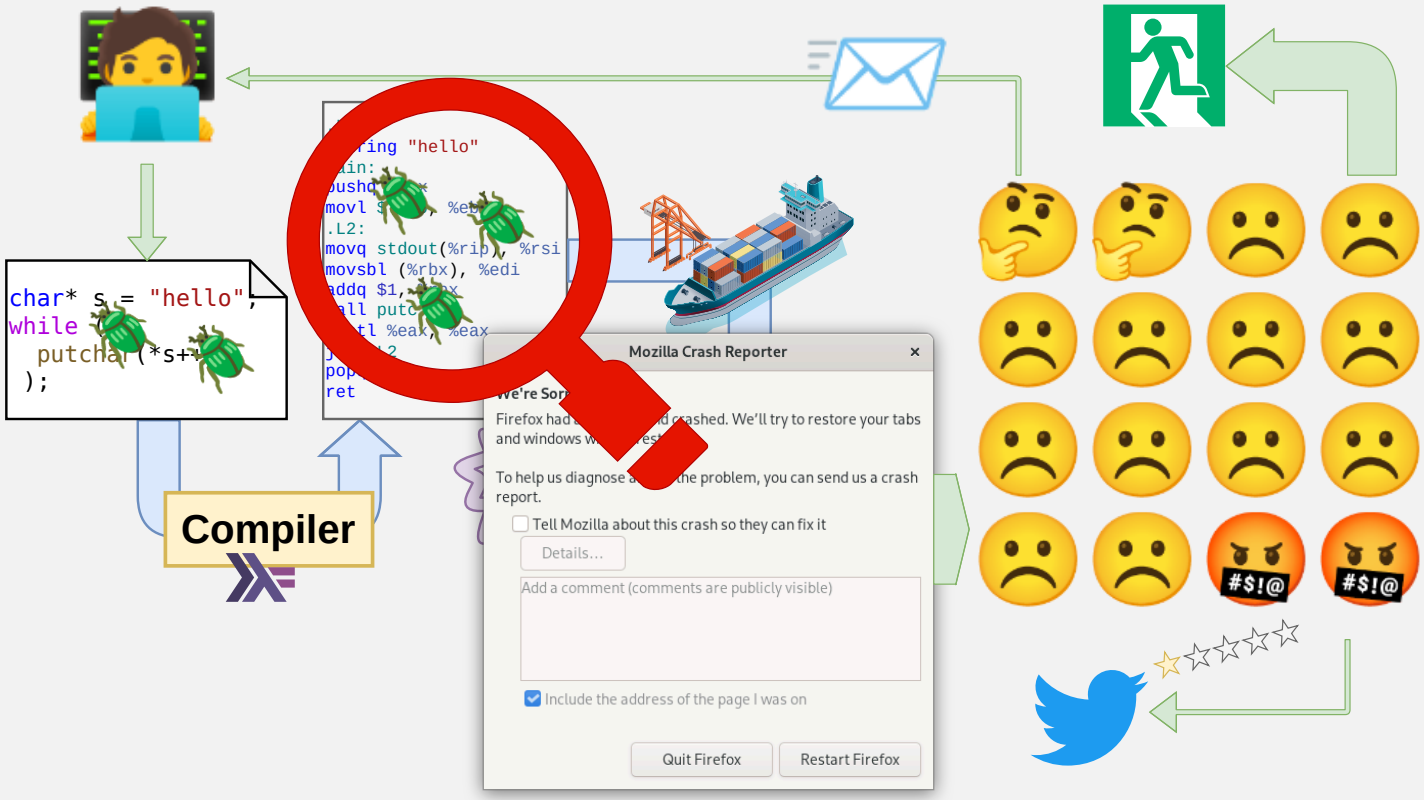

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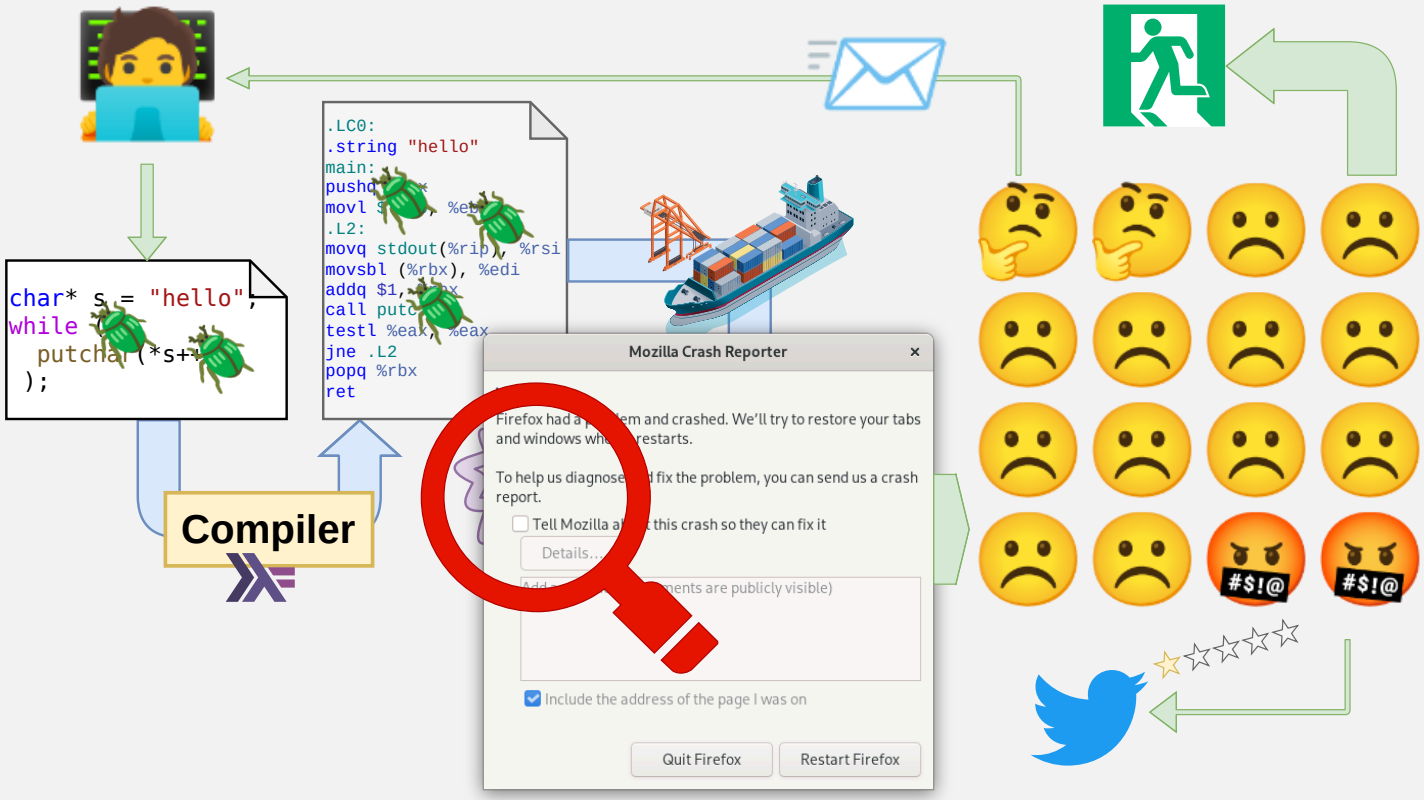

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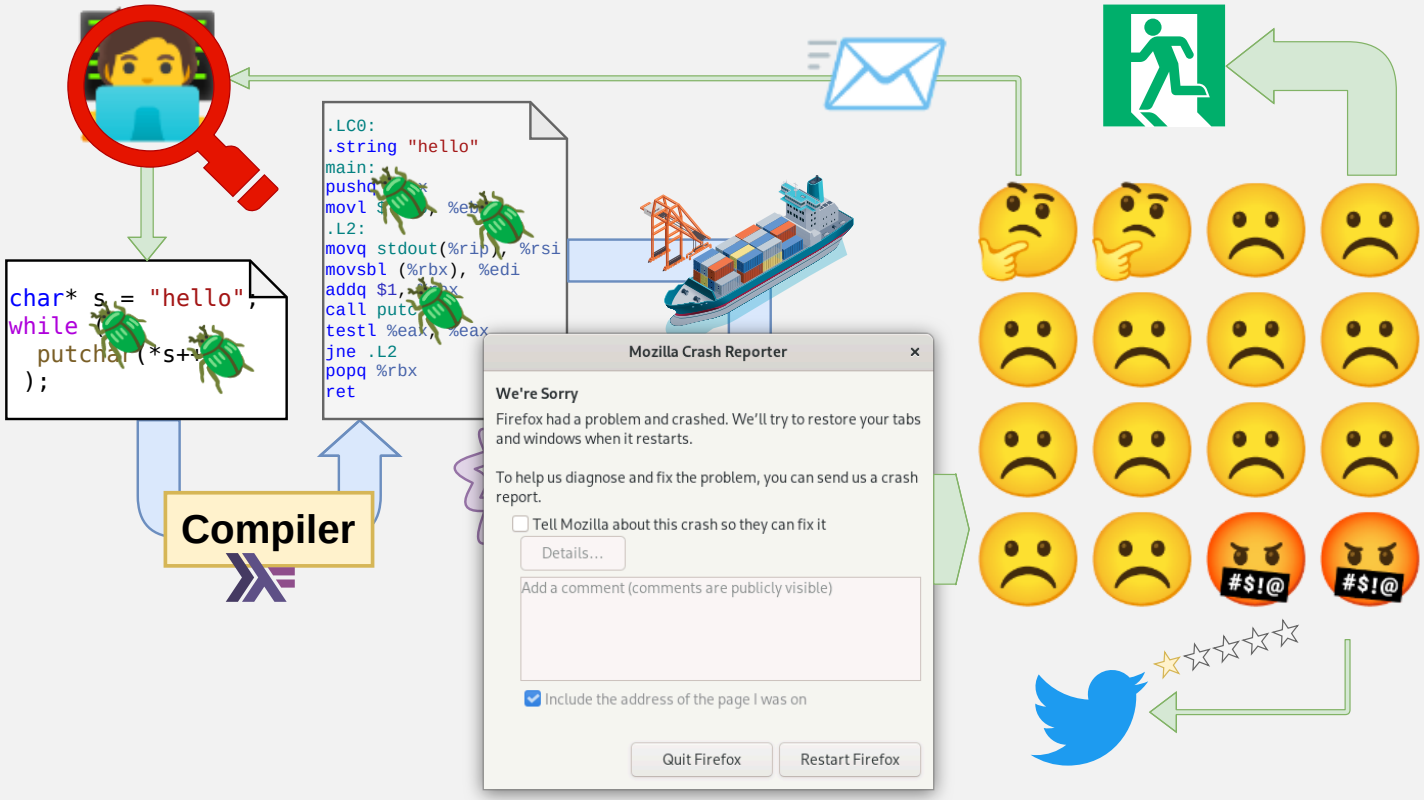

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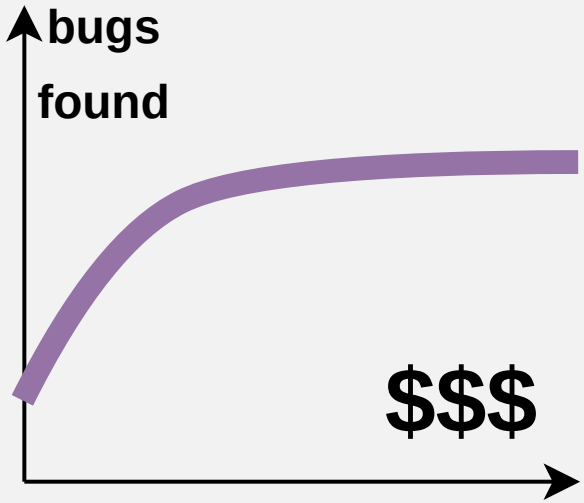

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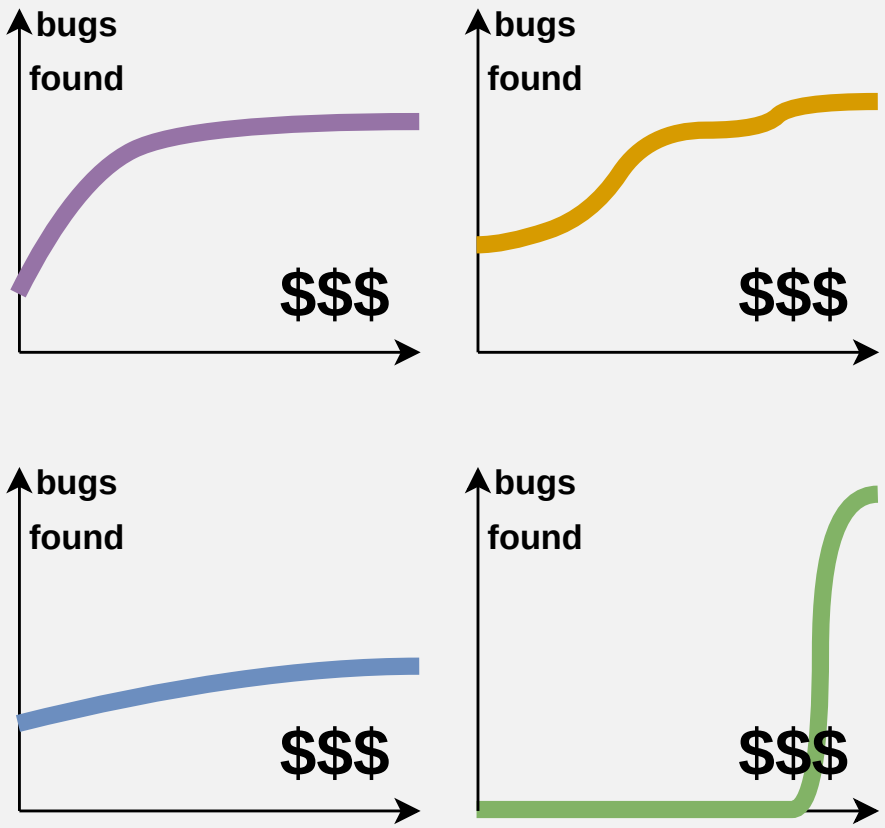

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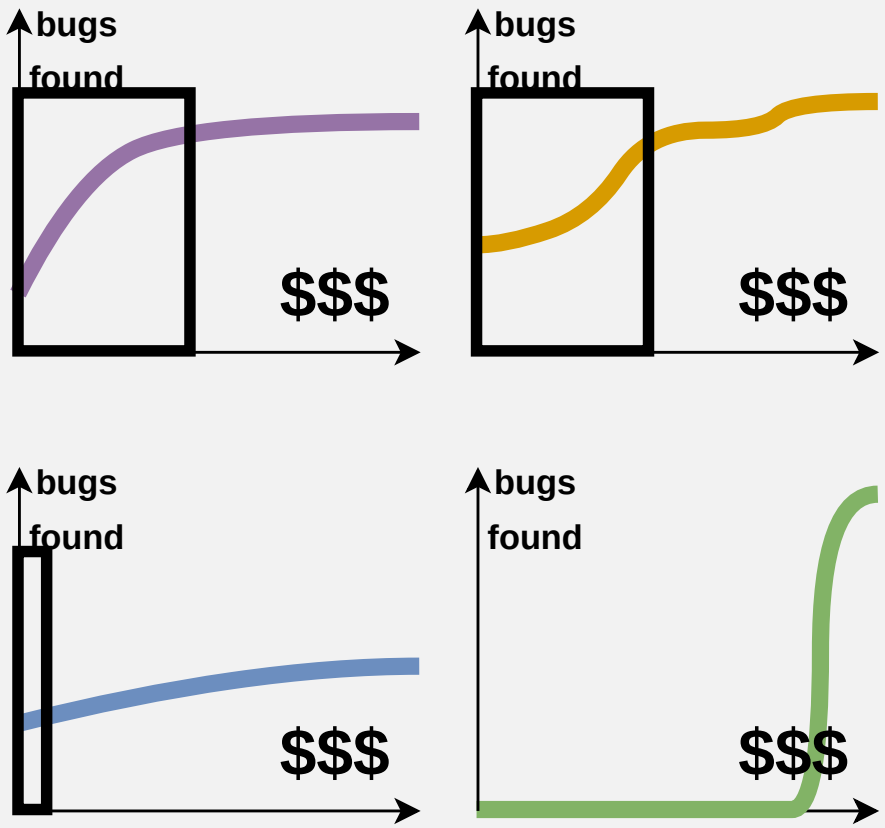

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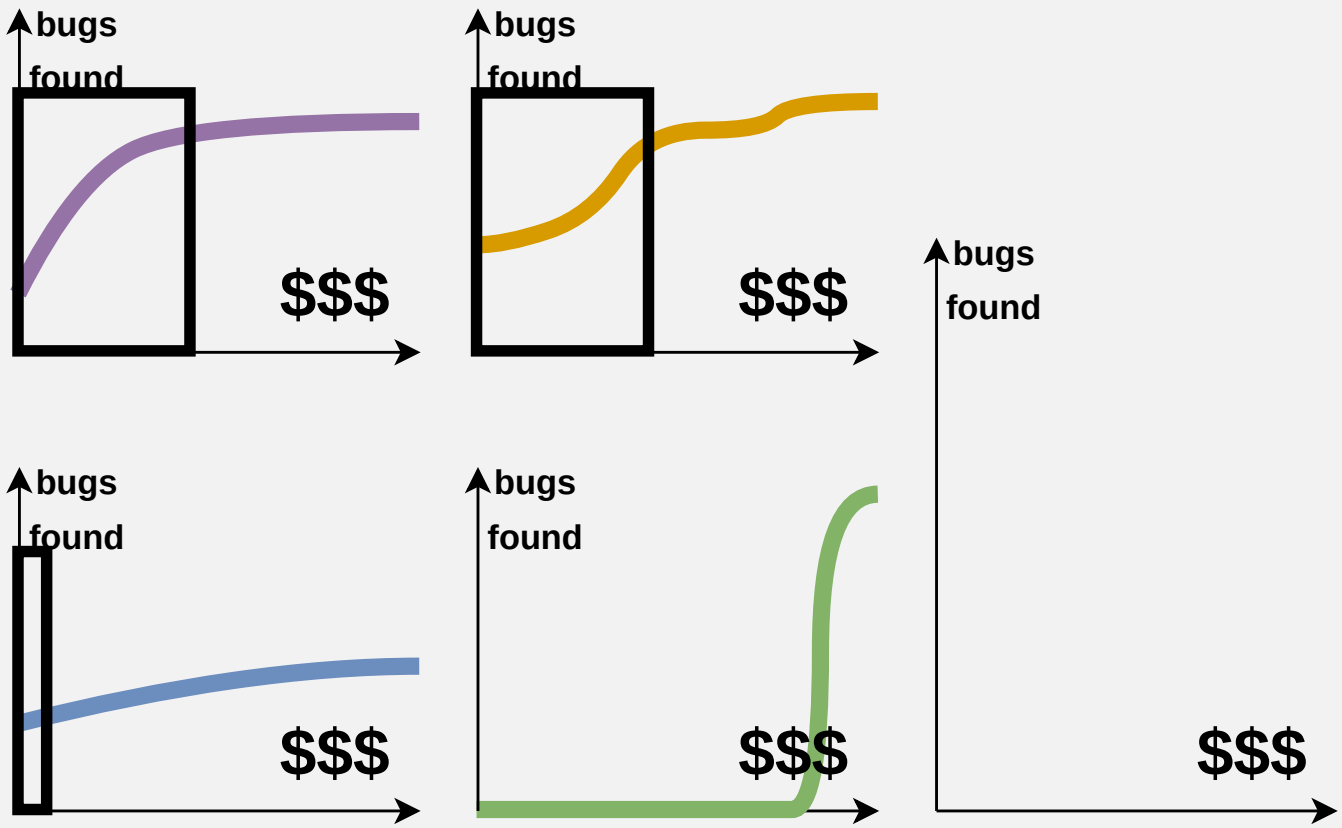

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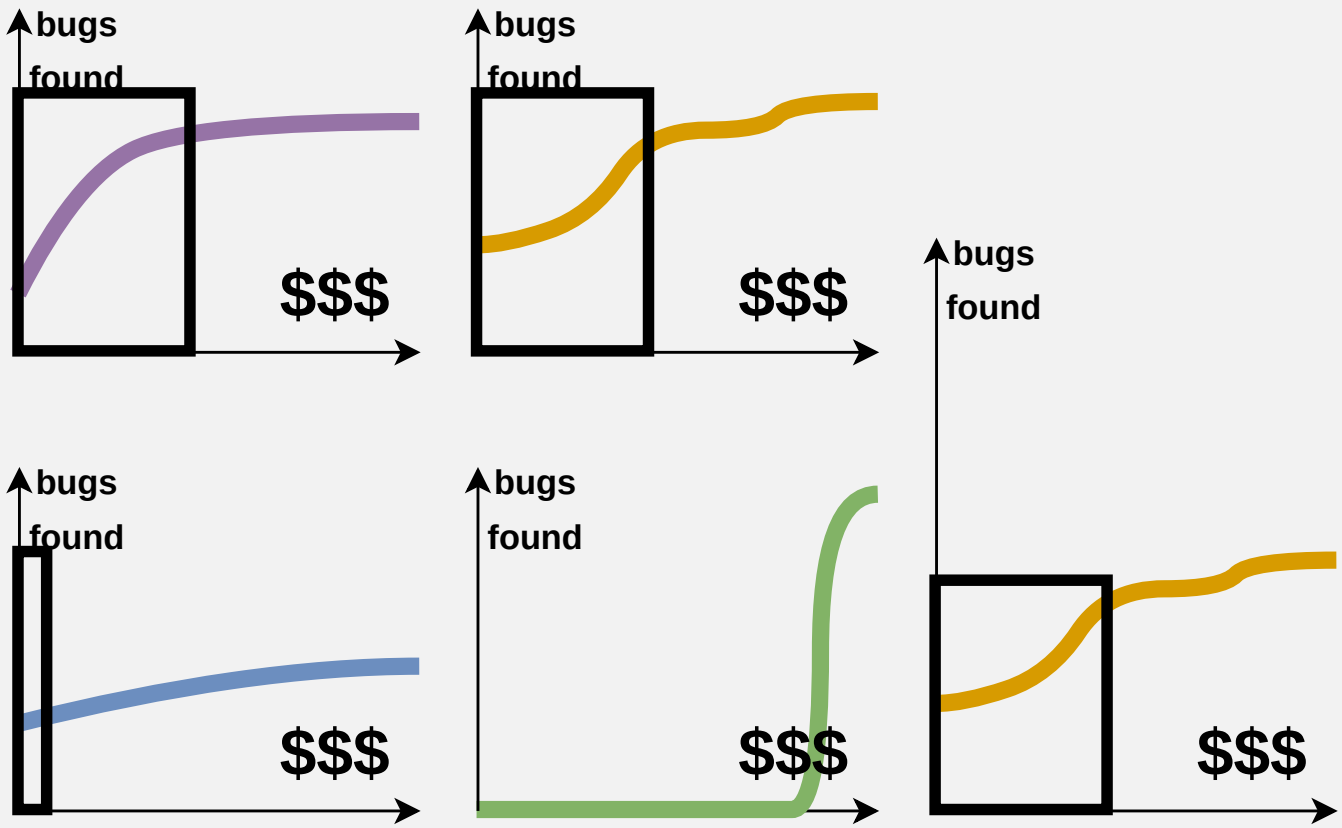

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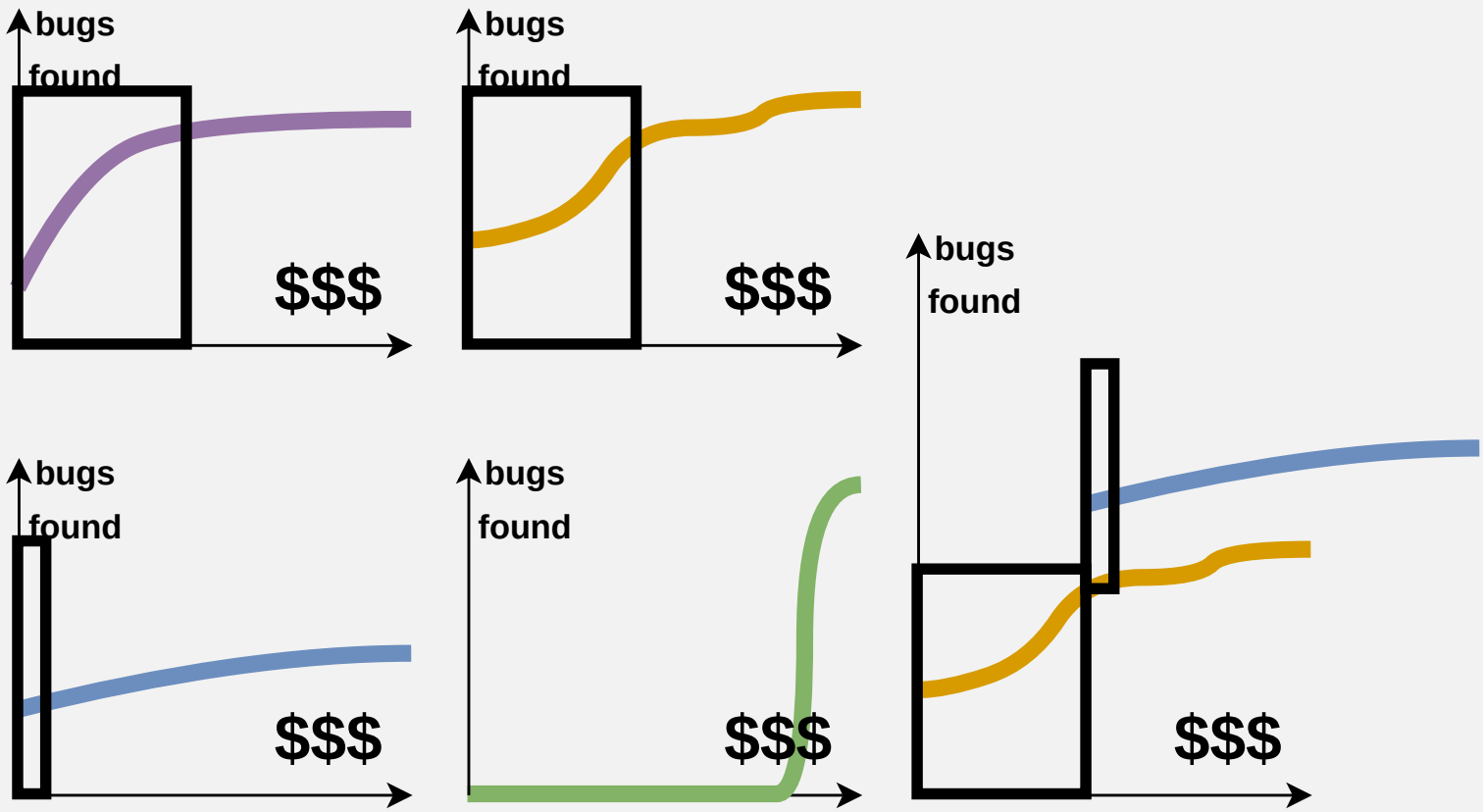

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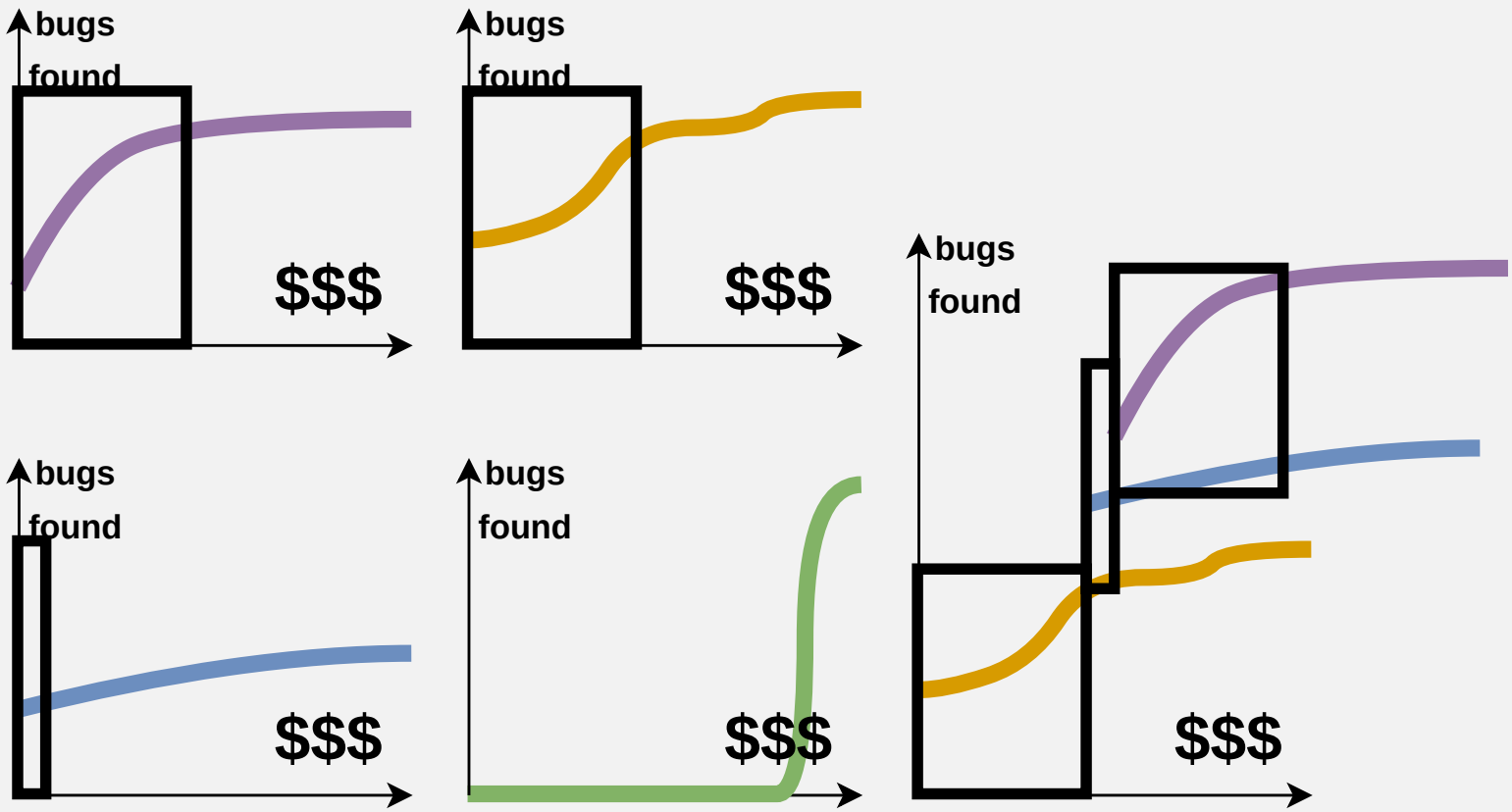

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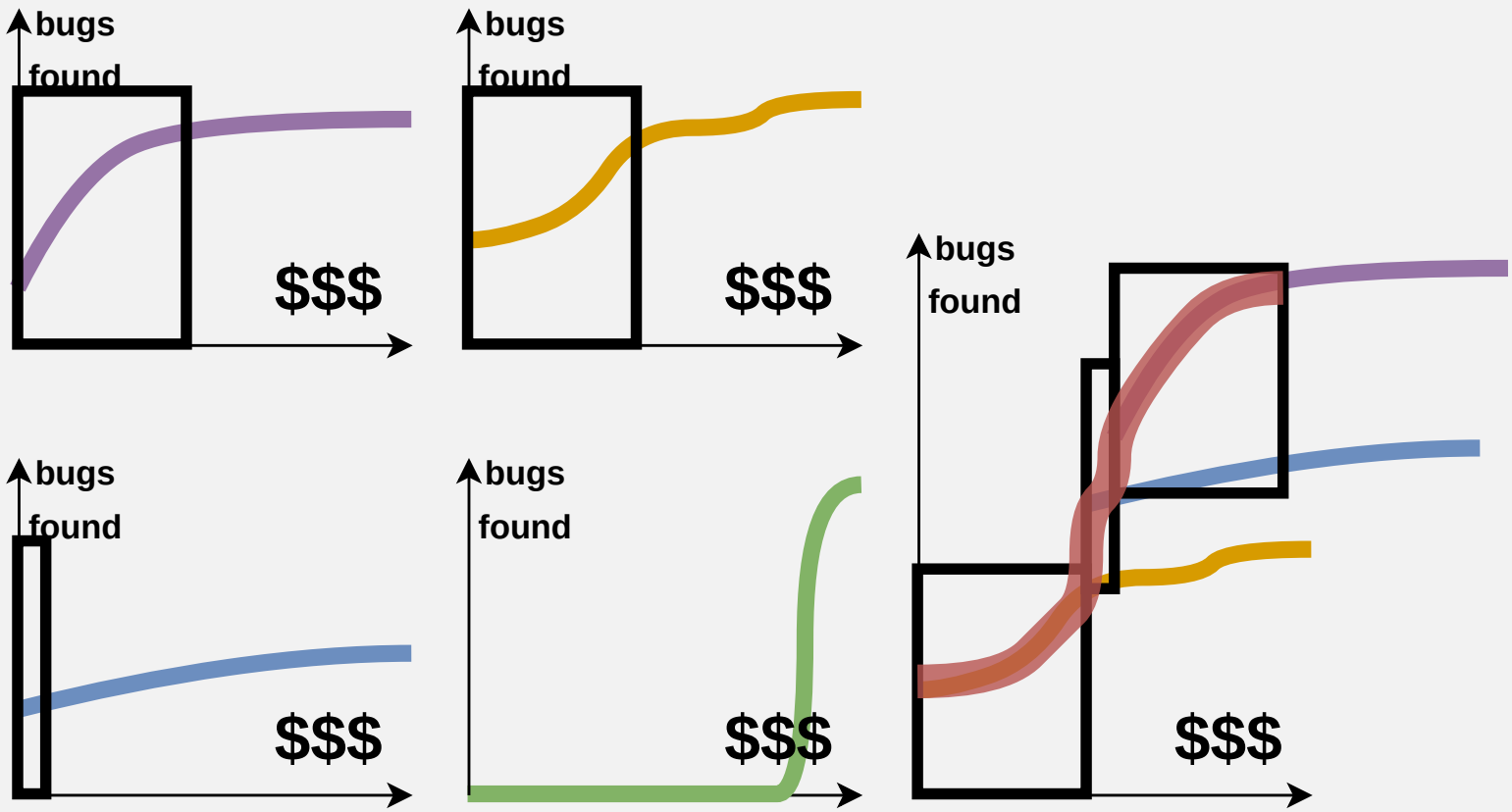

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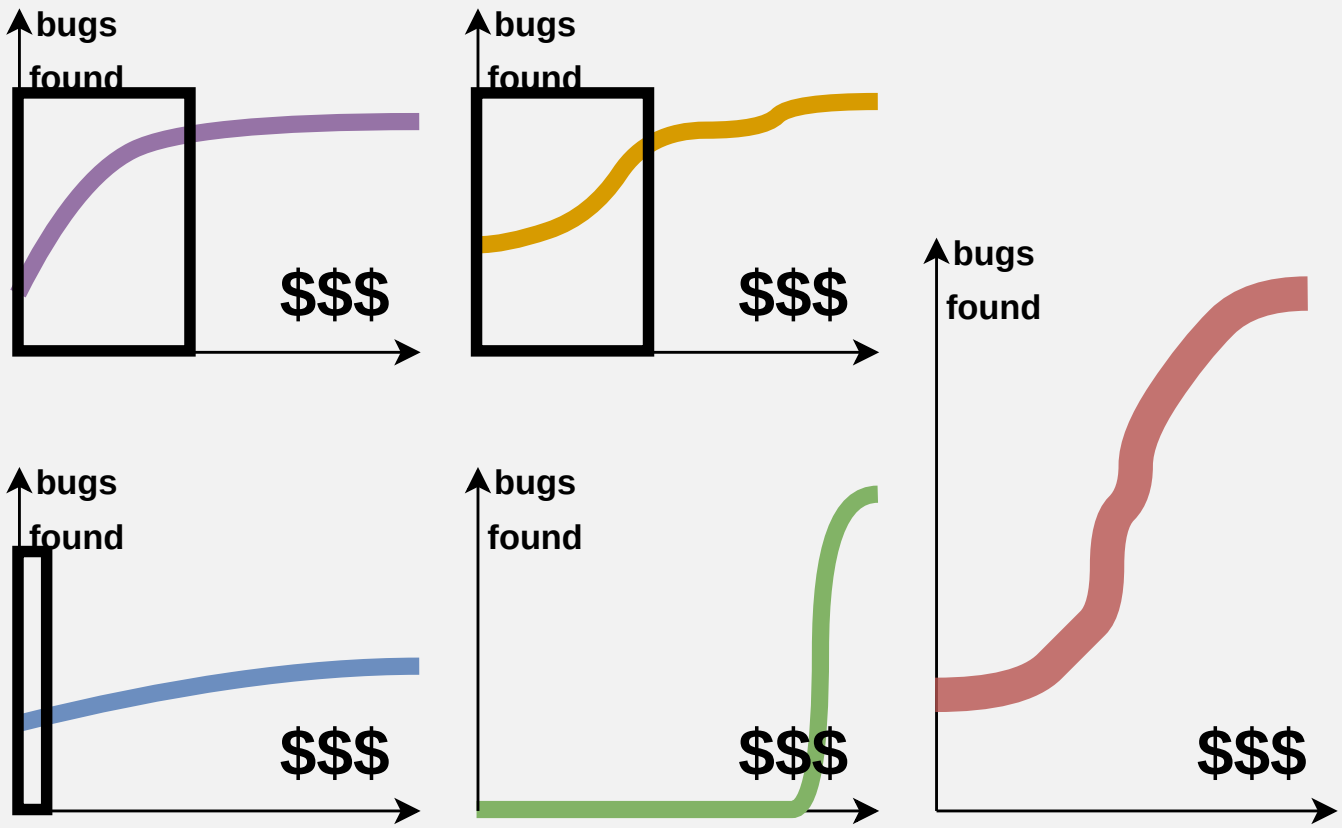
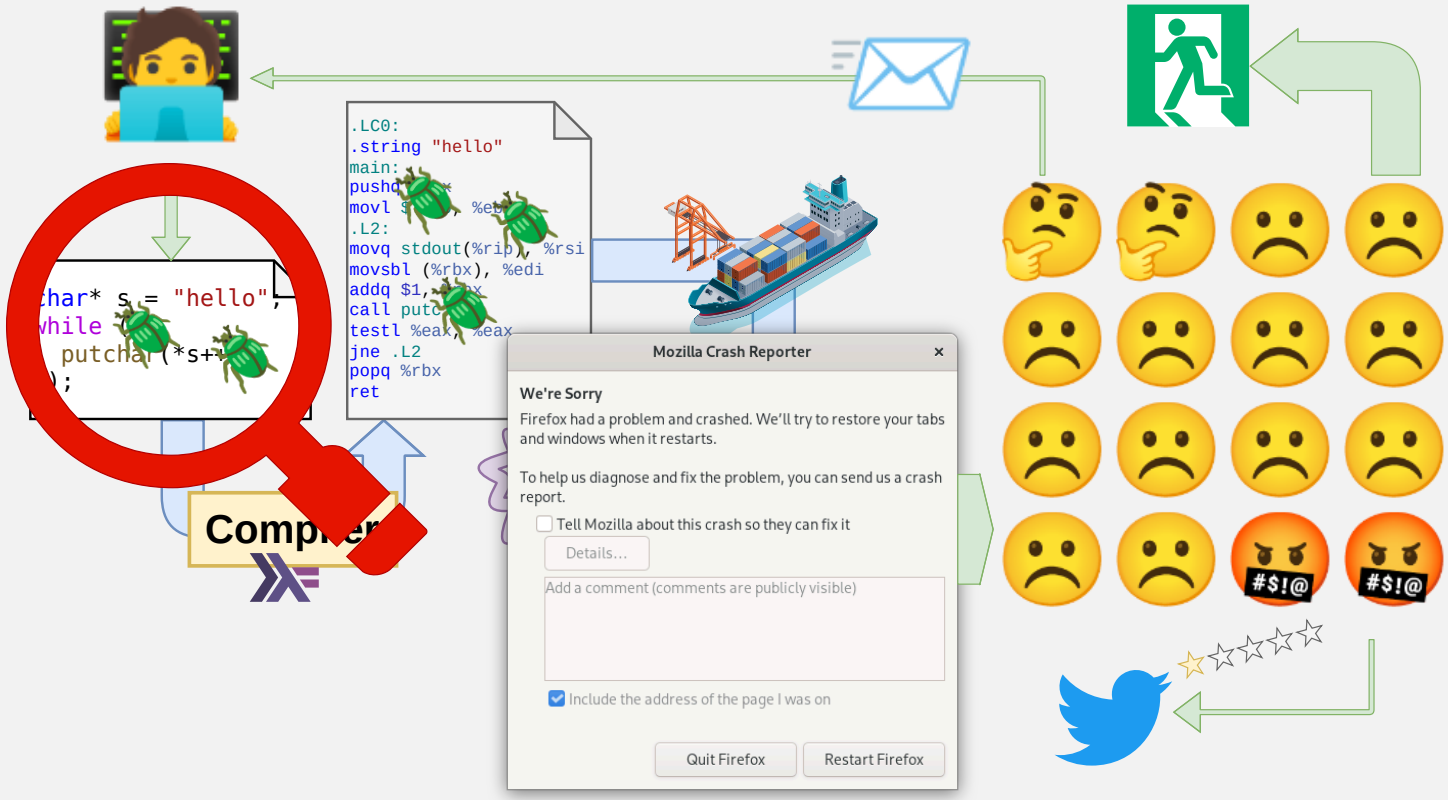


Who hunts for 🐞?



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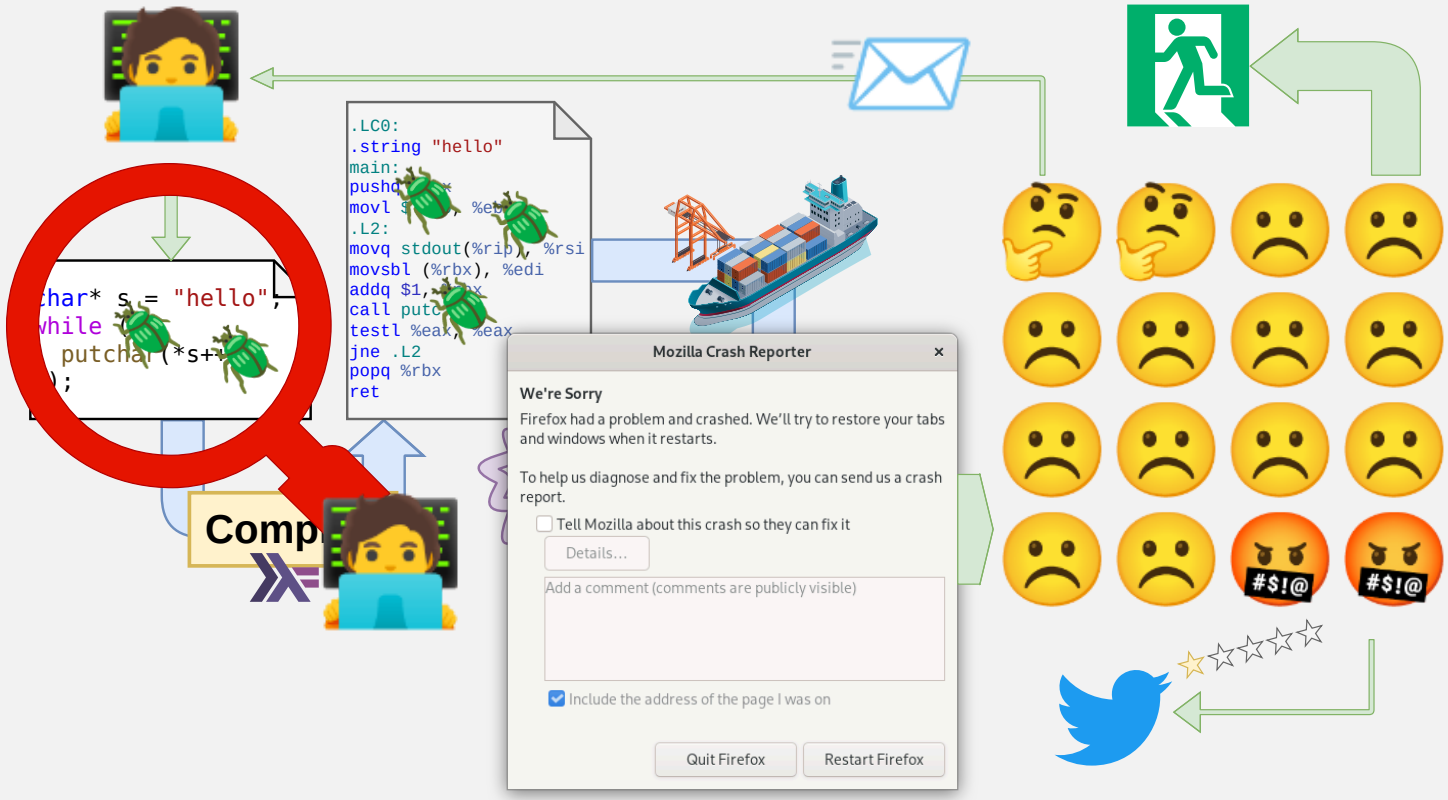

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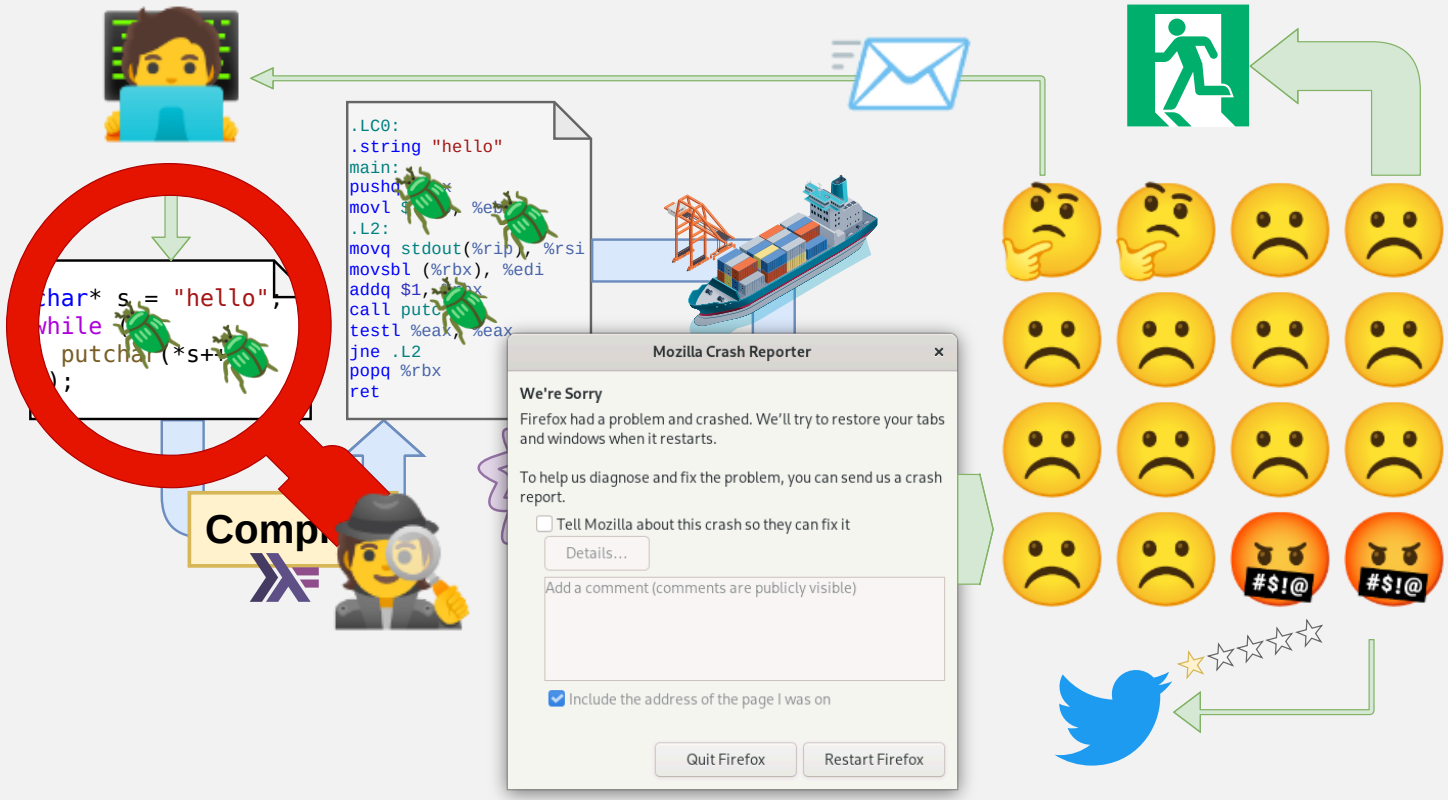

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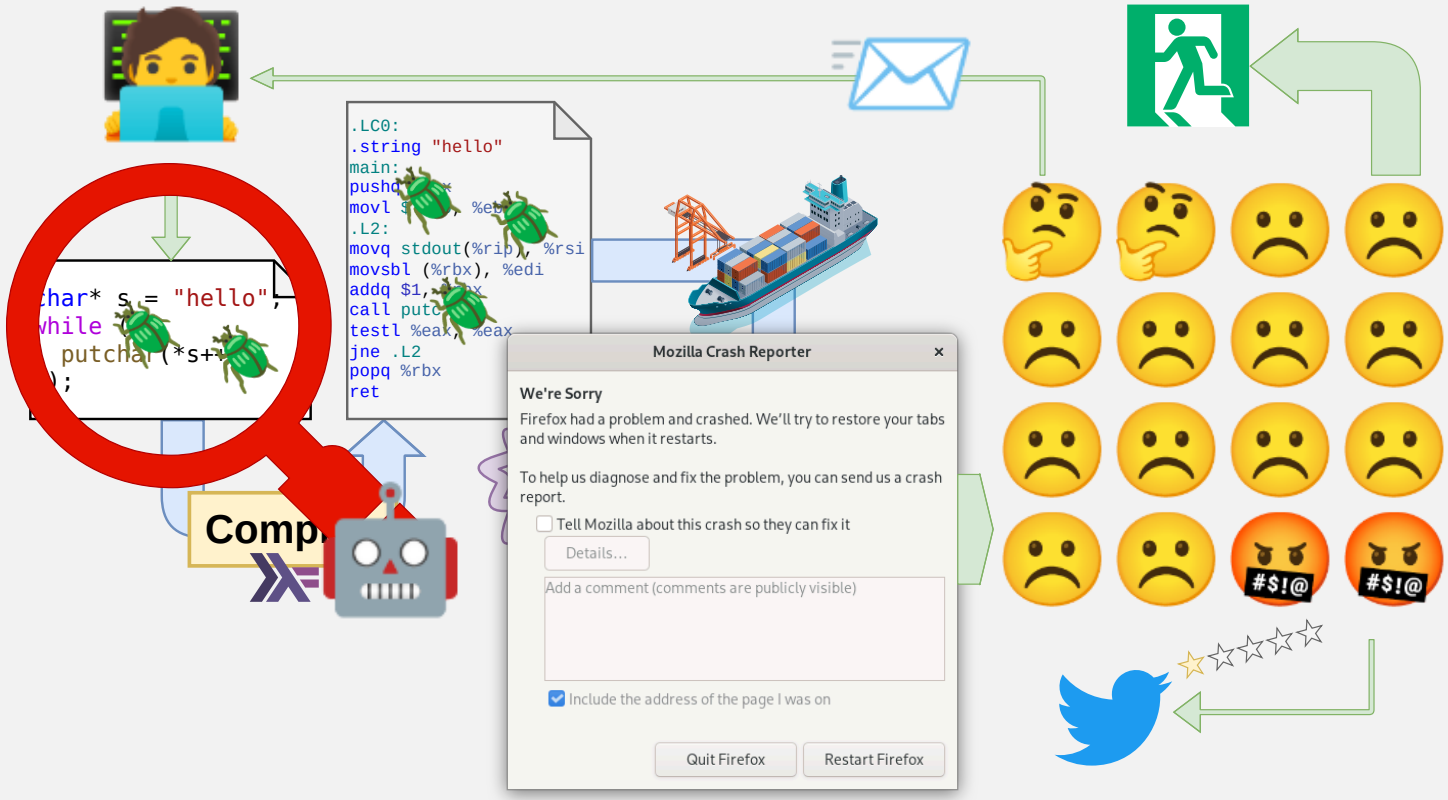
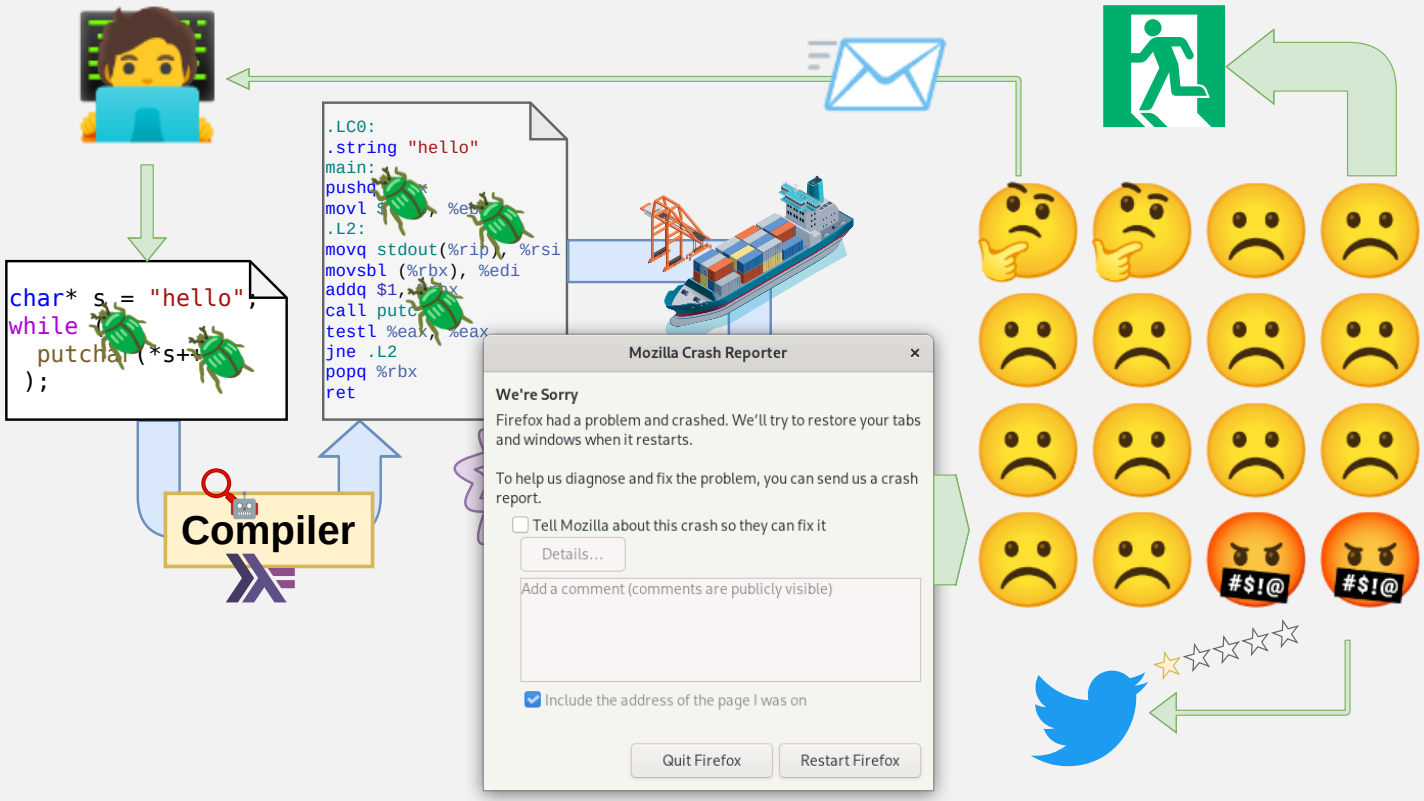
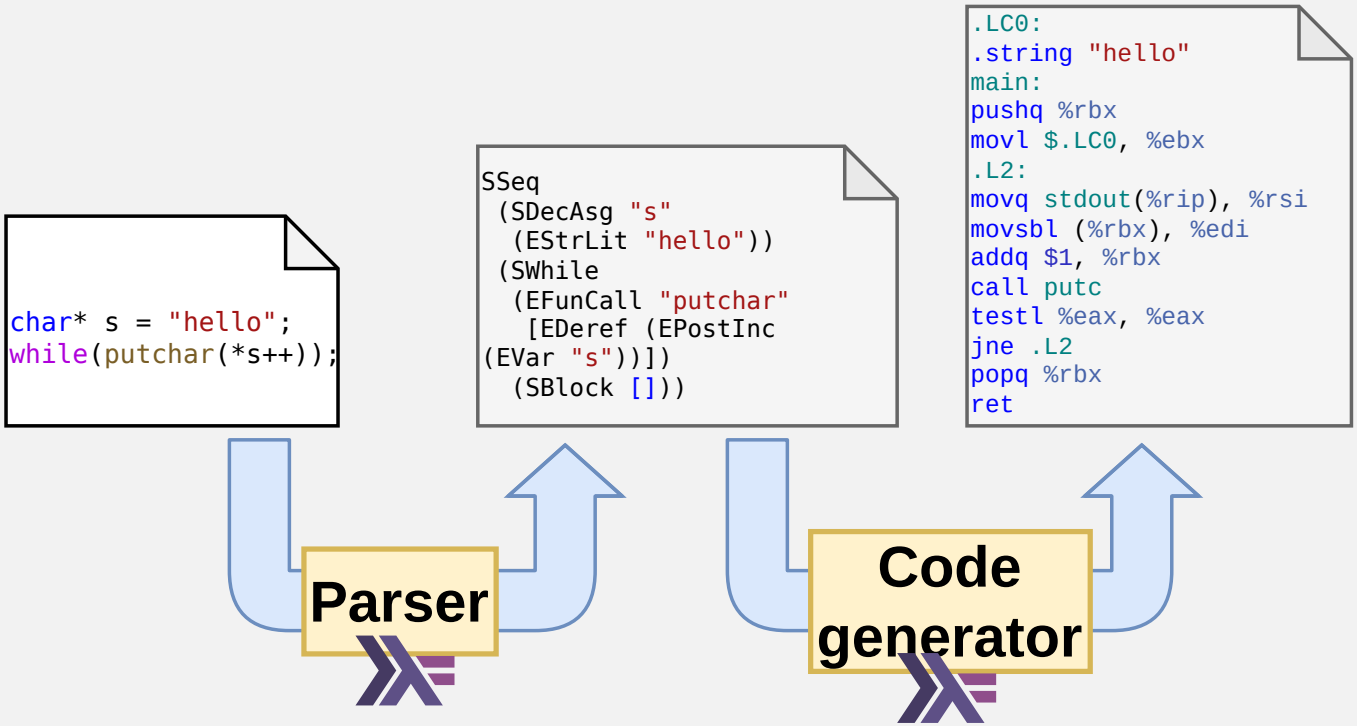


Compiler checks



Compiler checks, but where?



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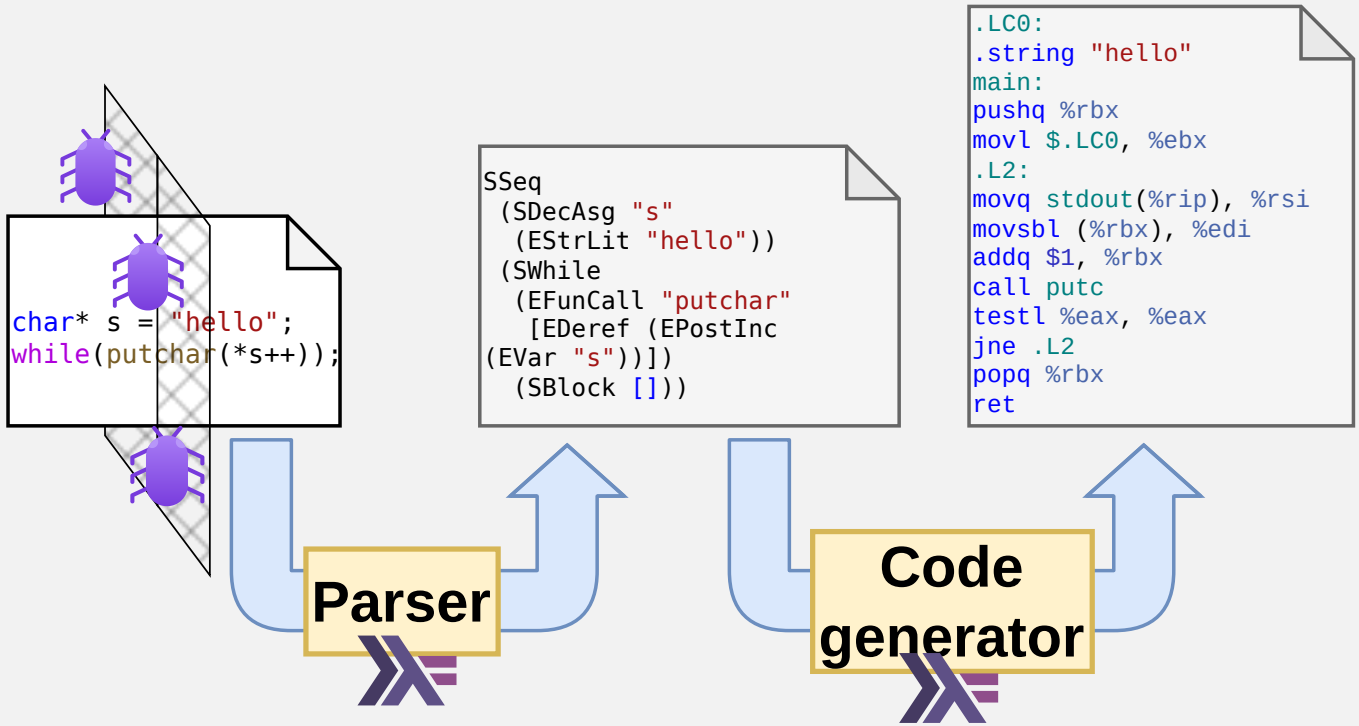

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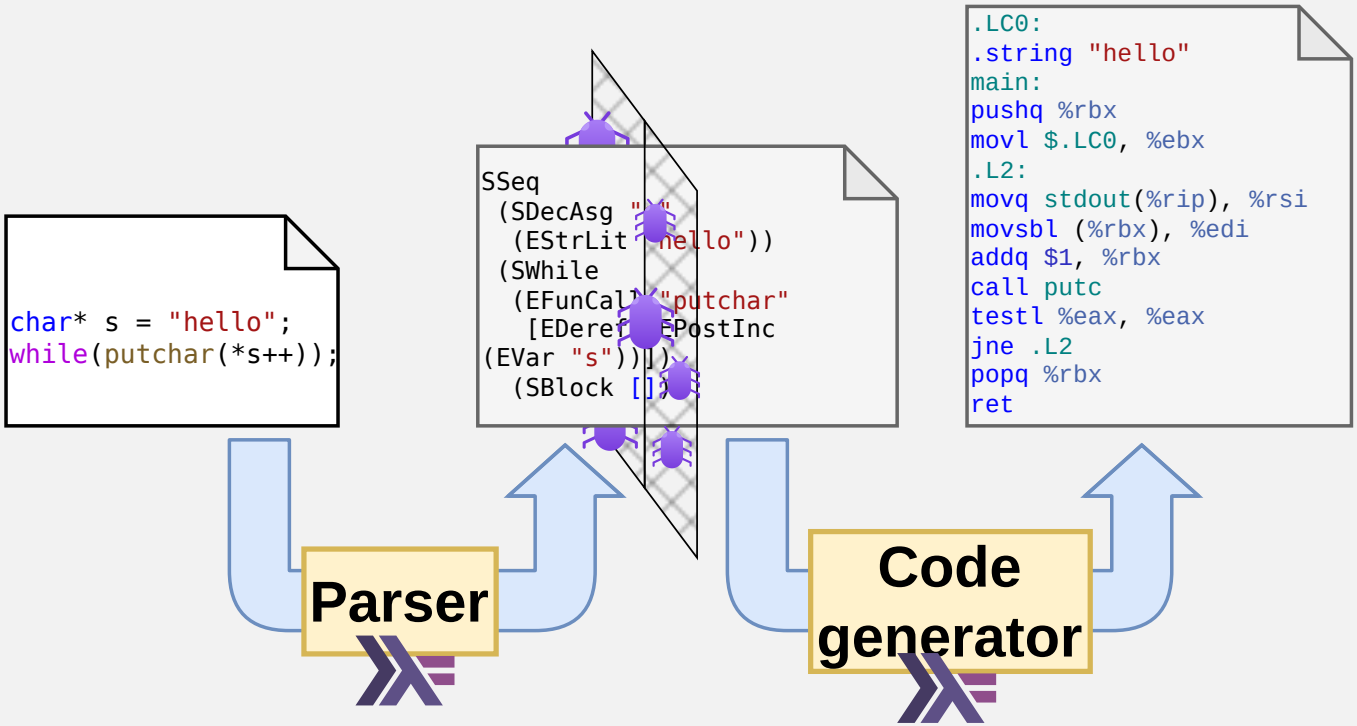

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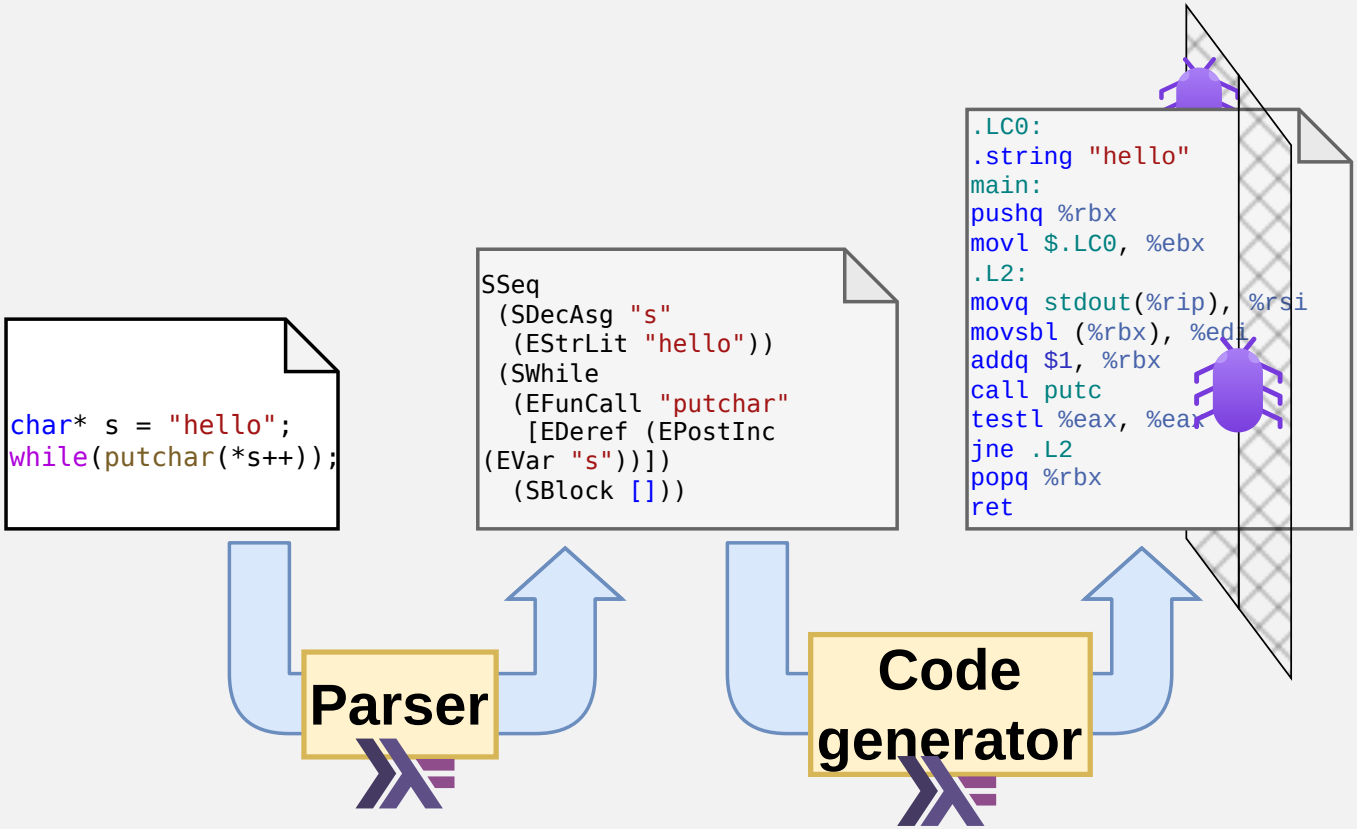

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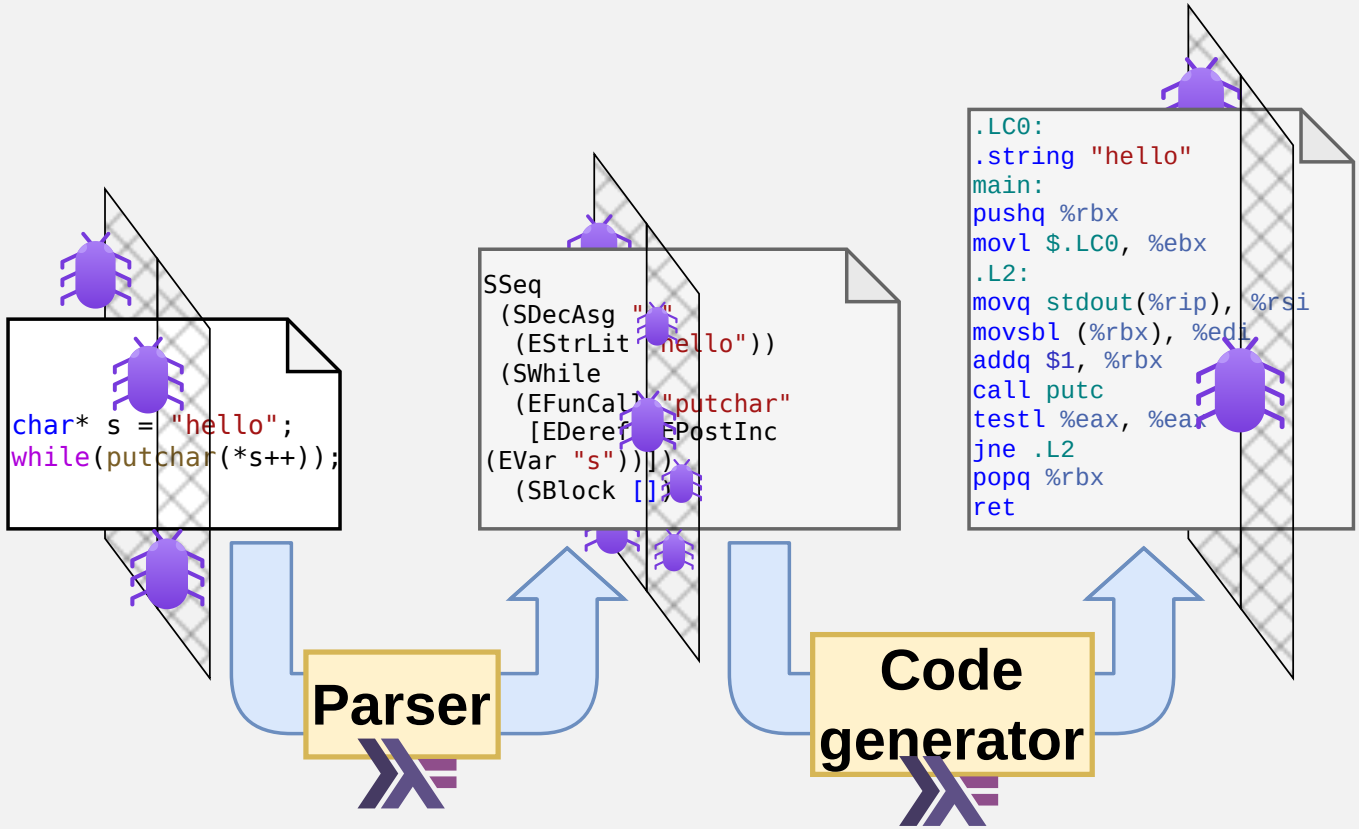

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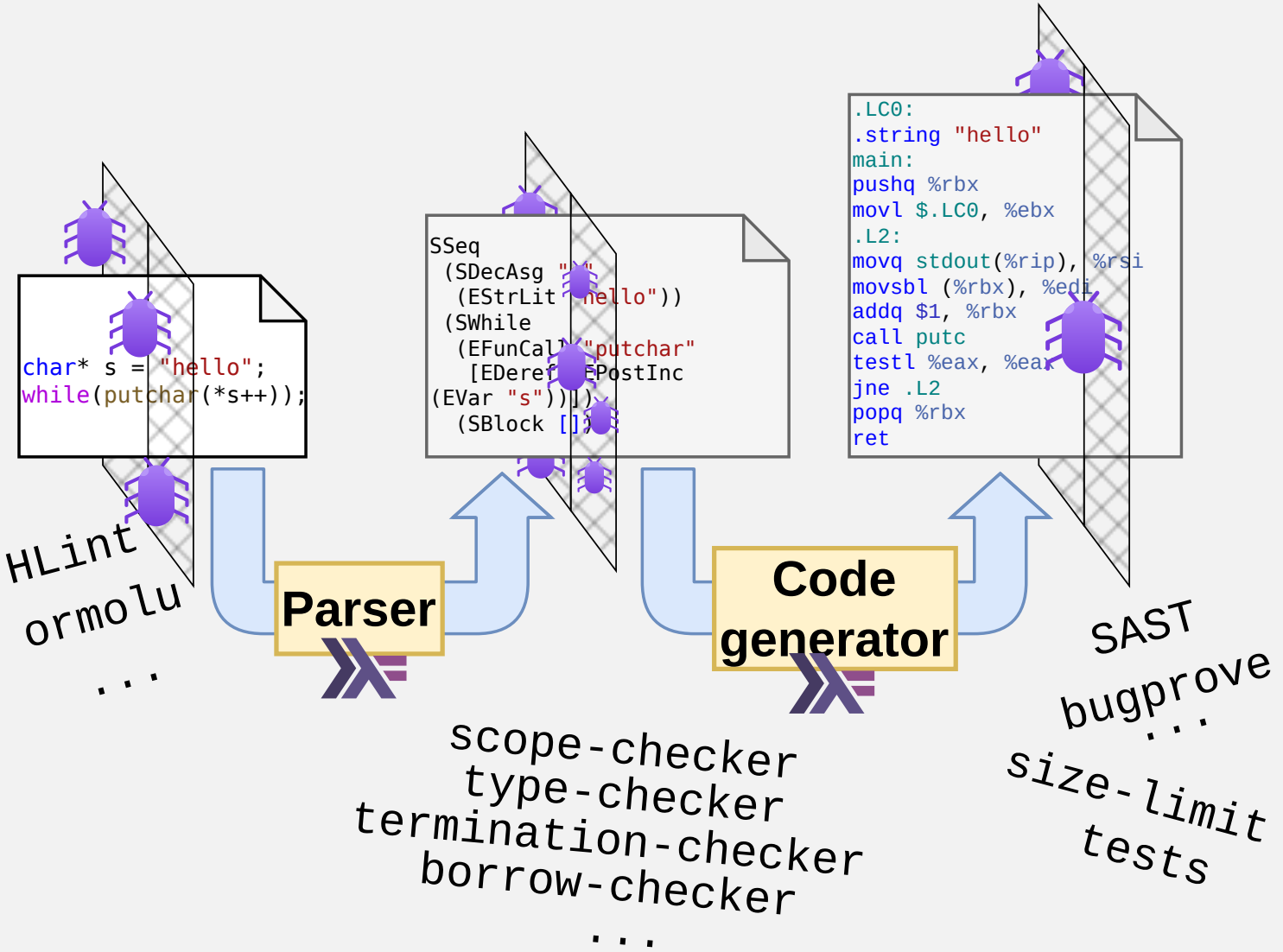

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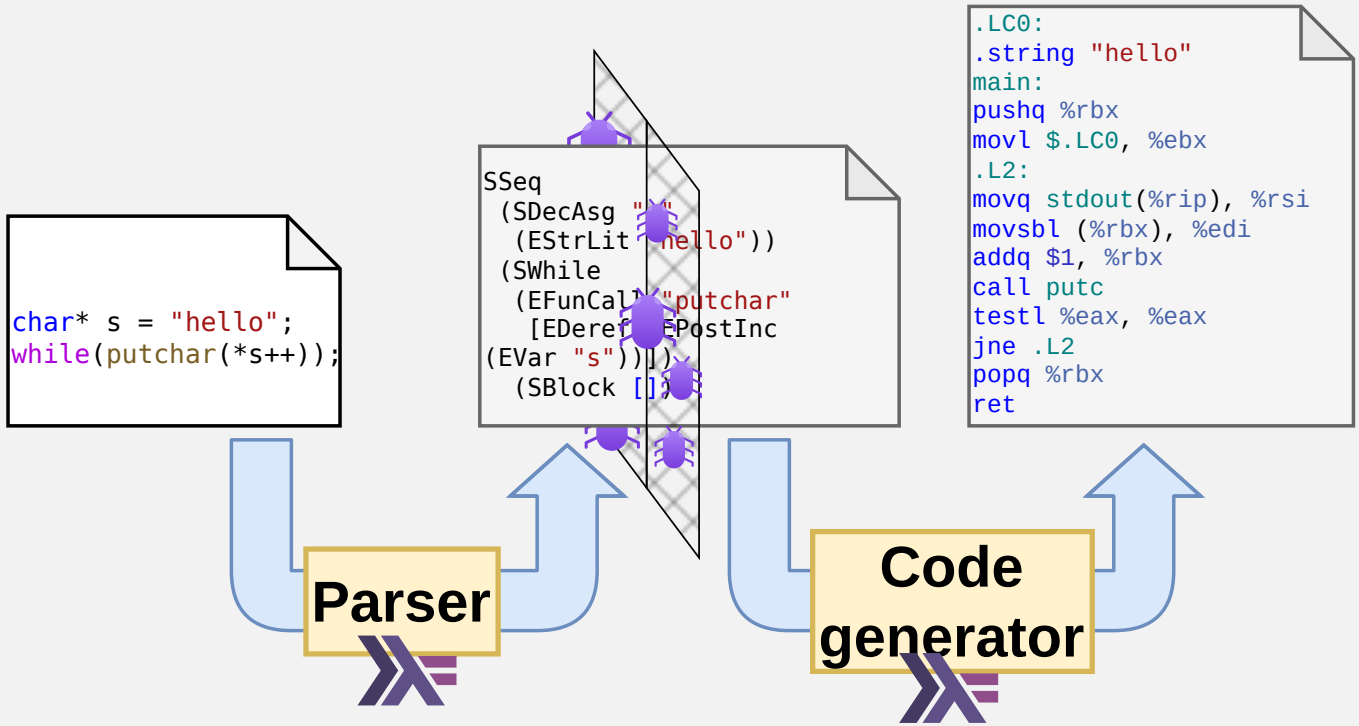



```
scope-checker
type-checker
termination-checker
borrow-checker
...
```

Example

(live coding)

Summary

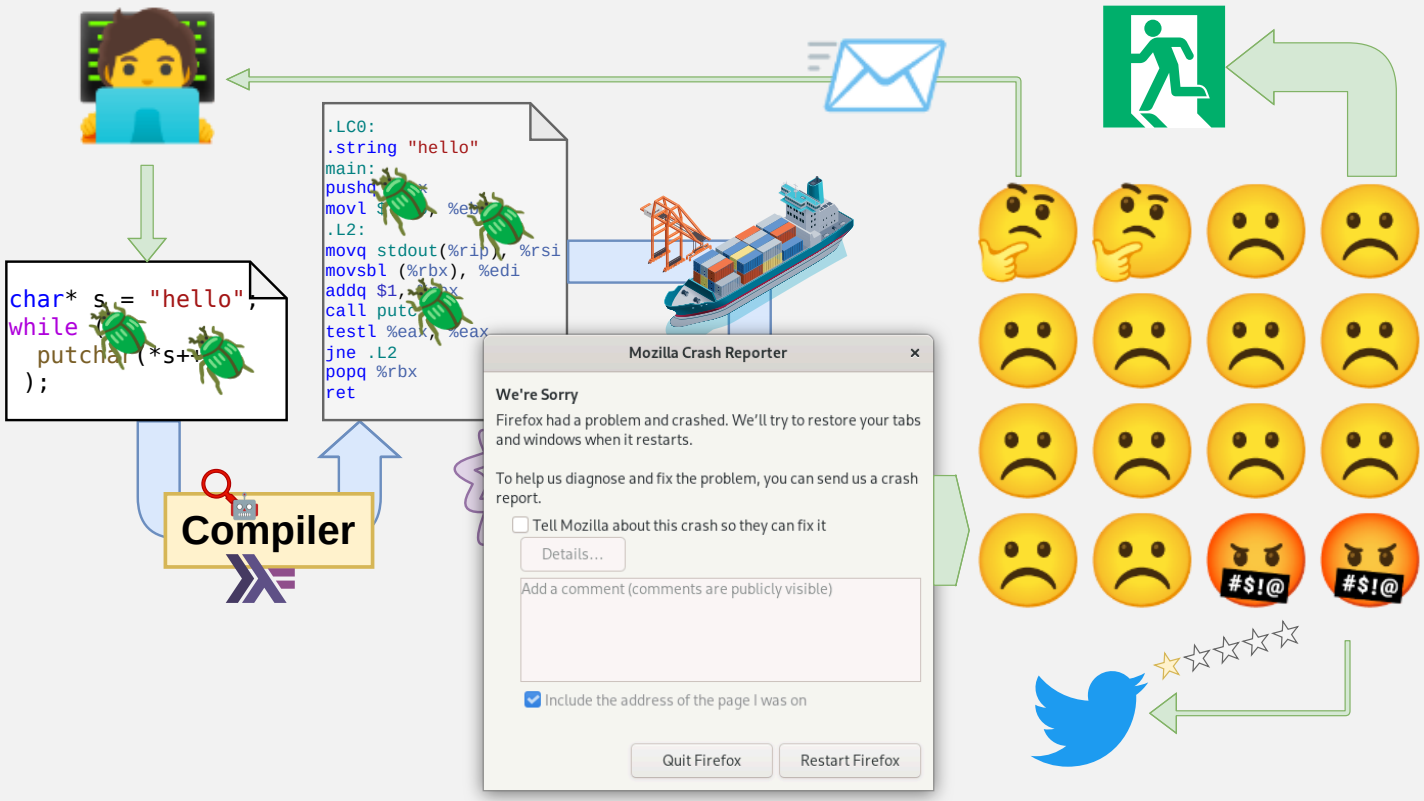
```
check :: Annotation -> Exp -> Bool

infer :: Exp -> Maybe Annotation

safeXXX e = infer e >> unsafeXXX e
```

Summary

```
check :: Annotation -> Exp -> Bool

infer :: Exp -> Maybe Annotation

safeXXX e = infer e >> unsafeXXX e
```

```
Valid a b ≅ Either a b

validate :: Exp -> Valid [ErrorMsg] AnnotatedExp

safeXXX e = safeXXX' <$> validate e
```

Summary


char* s = "hello";
while
putchar(*s++)
);
.LC0:
.string "hello"
main:
pushq
movl
.L2:
movq stdout(%rip), %rsi
movsbl (%rbx), %edi
addq $1,
call put
testl %eax, %eax
jne .L2
popq %rbx
ret
Compiler
Mozilla Crash Reporter
We're Sorry
Firefox had a problem and crashed. We'll try to restore your tabs and windows when it restarts.
To help us diagnose and fix the problem, you can send us a crash report.
Tell Mozilla about this crash so they can fix it
Details...
Add a comment (comments are publicly visible)
Include the address of the page I was on
Quit Firefox
Restart Firefox
#$!@
#$!@