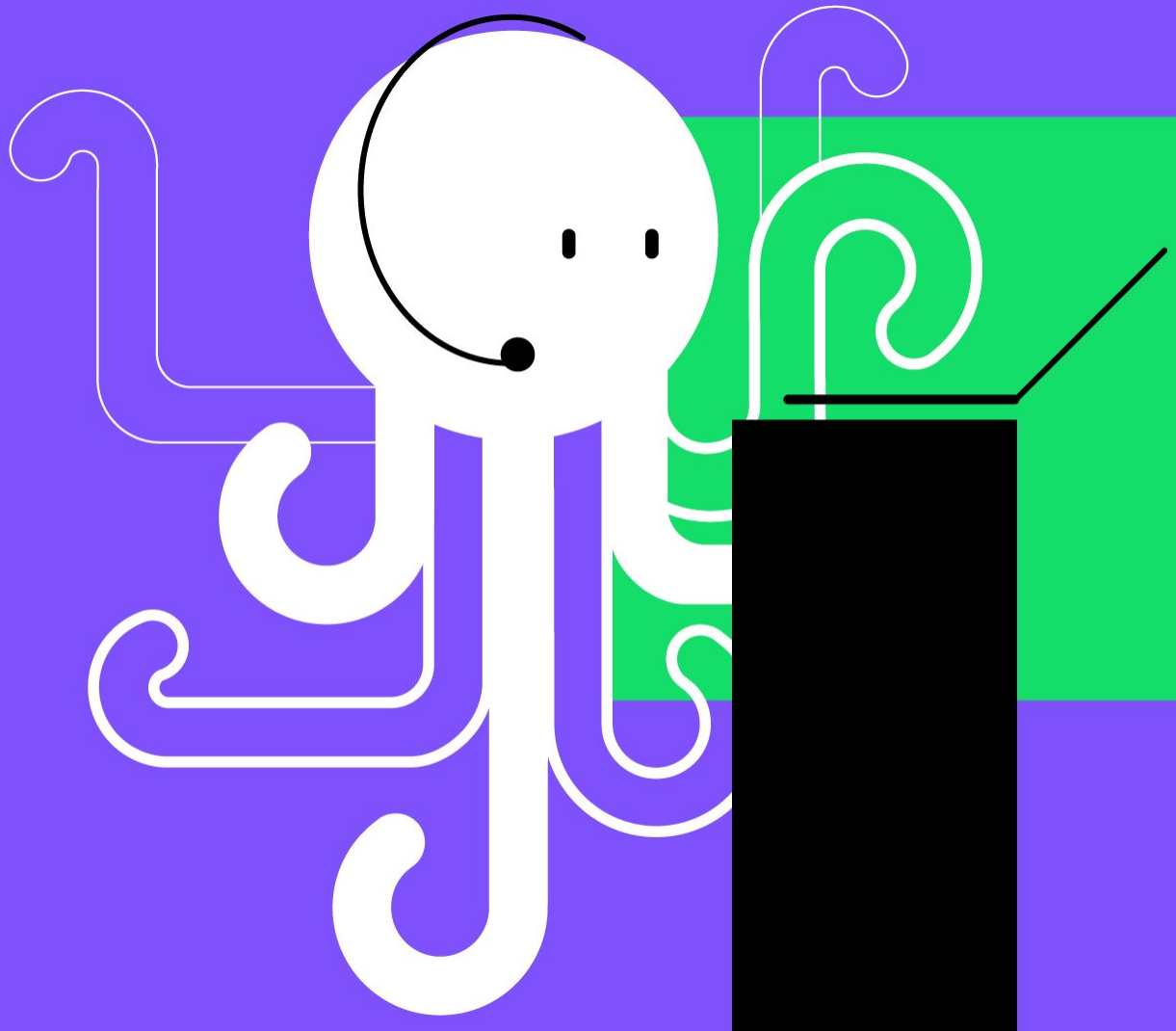


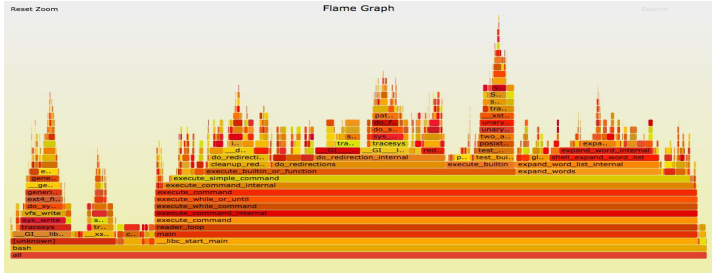
Finding performance bugs in Kotlin compiler via fuzzing

WIP report

Стажер: Дмитрий Волков
Ментор: Виктор Петухов
Тимофей Брыксин
Ярослав Соколов

```
$ time kotlinc ./my.kt
Slow!
```

```
Premature optimisation is
the root
```



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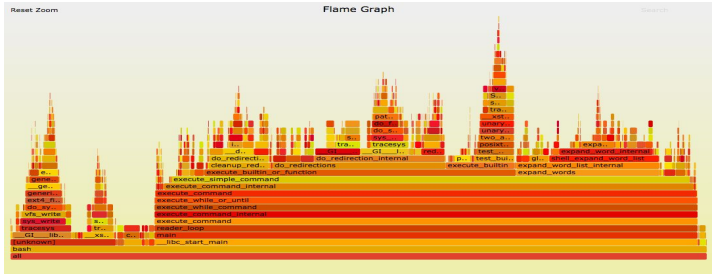
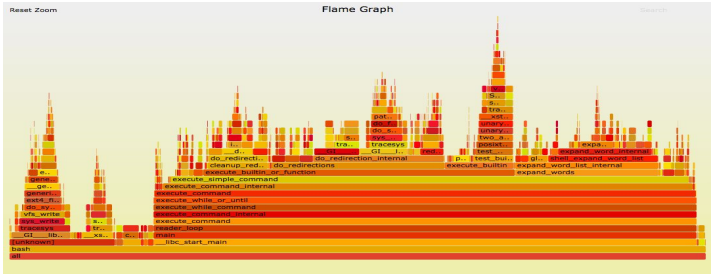



```
kotlin.git/benchmarks
```

```
profiler
```



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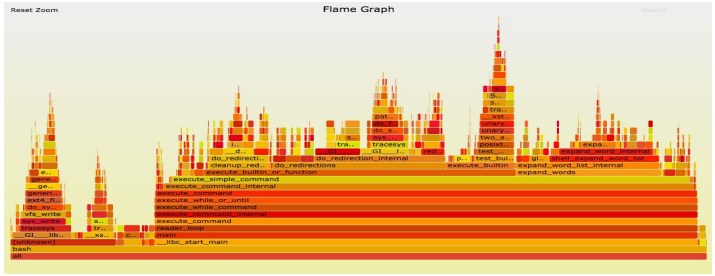


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kotlin.git/benchmarks
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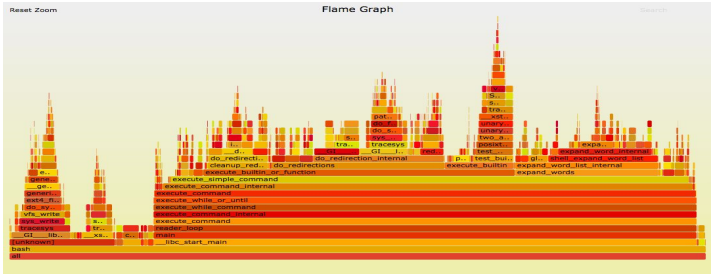
Only cover what we know

+

profiler

=



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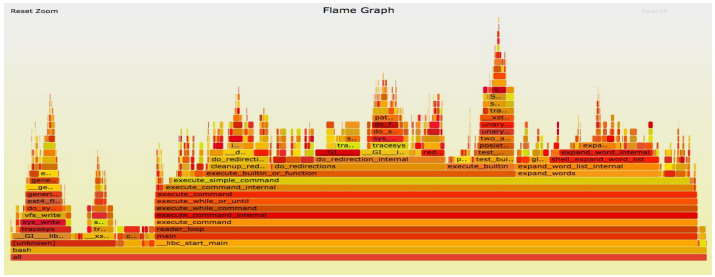



```
generate benchmarks
on-the-fly
```

Only cover what we know

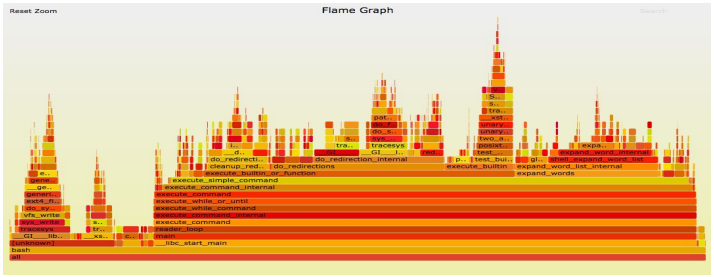
+

```
profiler
```

feedback

=

fuzzing



Prior work: American Fuzzy Lop

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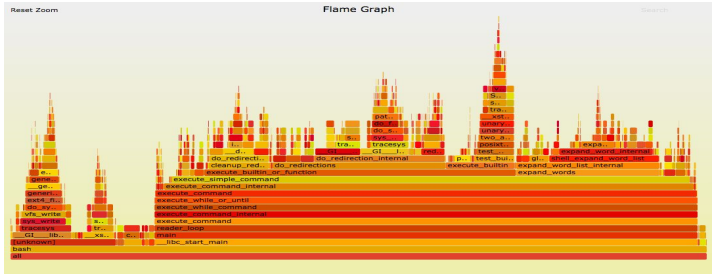


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```
profiler
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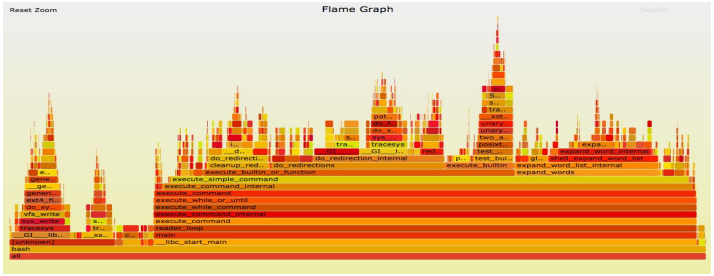
=

fuzzing



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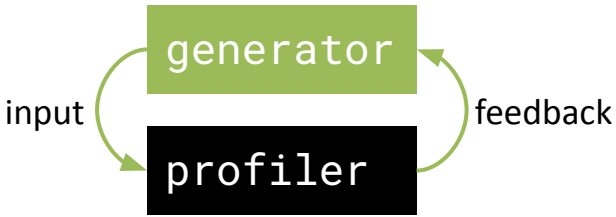
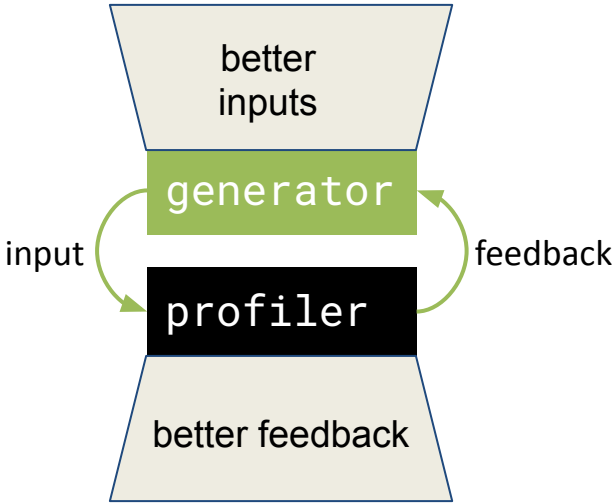
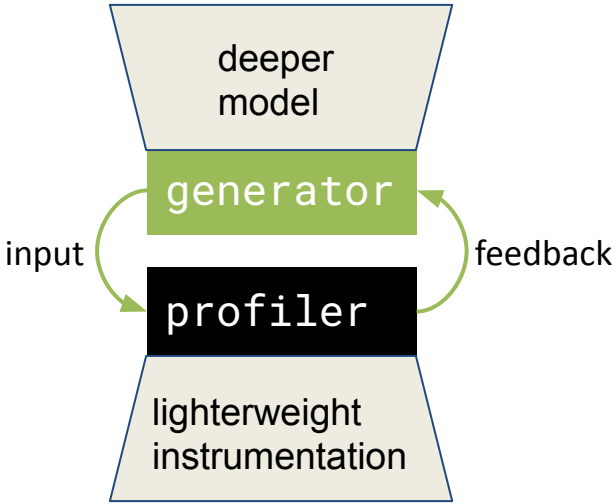
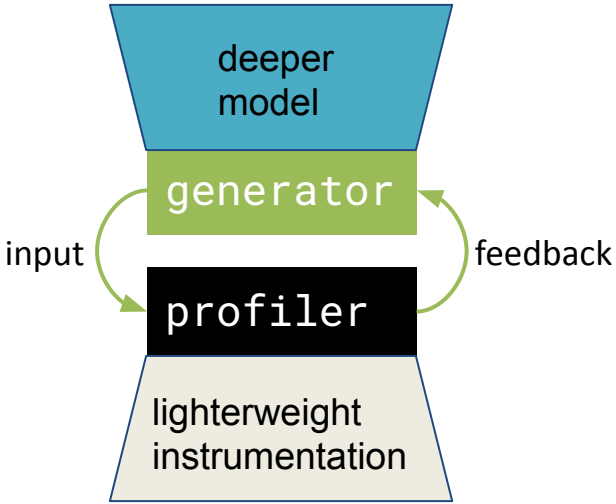
Prior work: American Fuzzy Lop

DOES NOT WORK


generator
input
feedback
profiler


better
inputs
generator
input
feedback
profiler
better feedback


deeper
model
generator
input
feedback
profiler
lighterweight
instrumentation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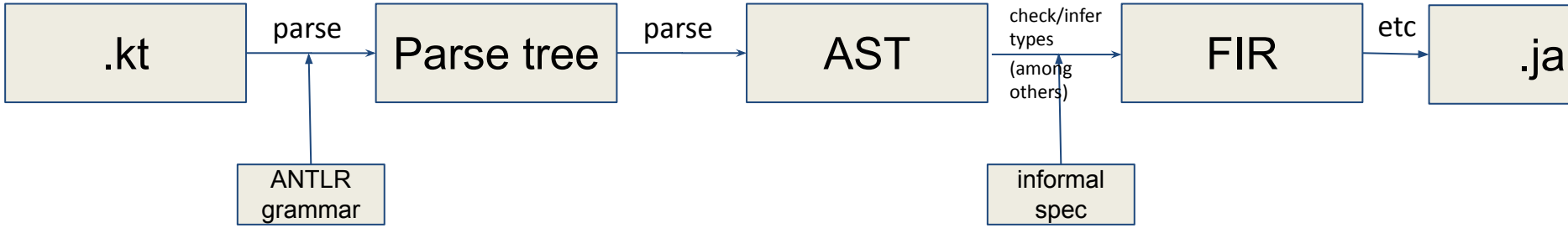
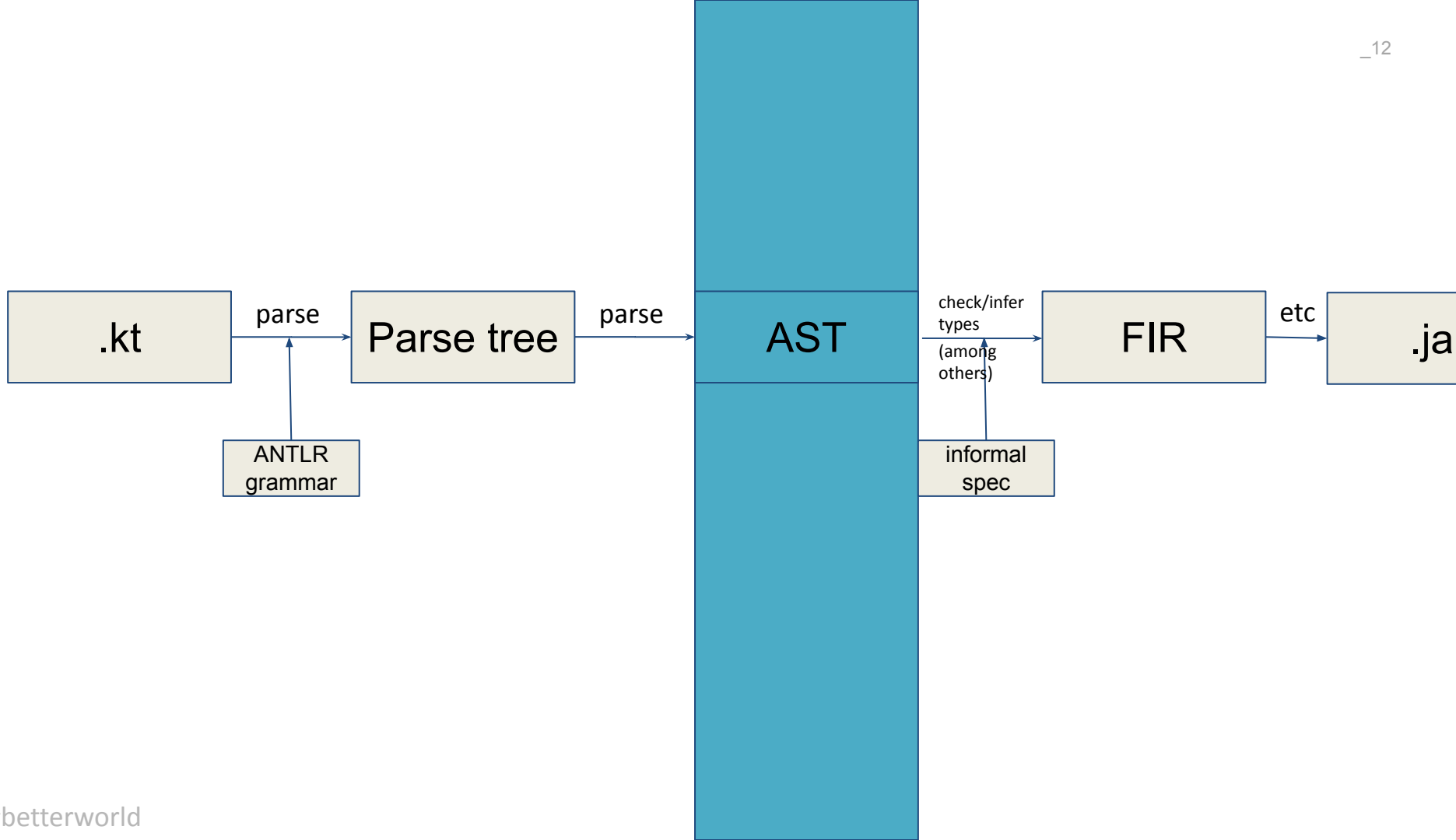

.kt
parse
Parse tree
parse
AST
check/infer types
(among others)
FIR
etc
.ja
ANTLR grammar
informal spec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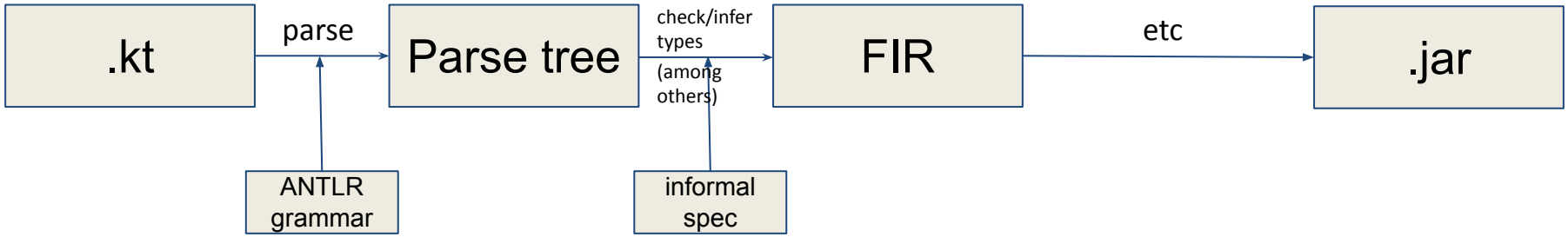
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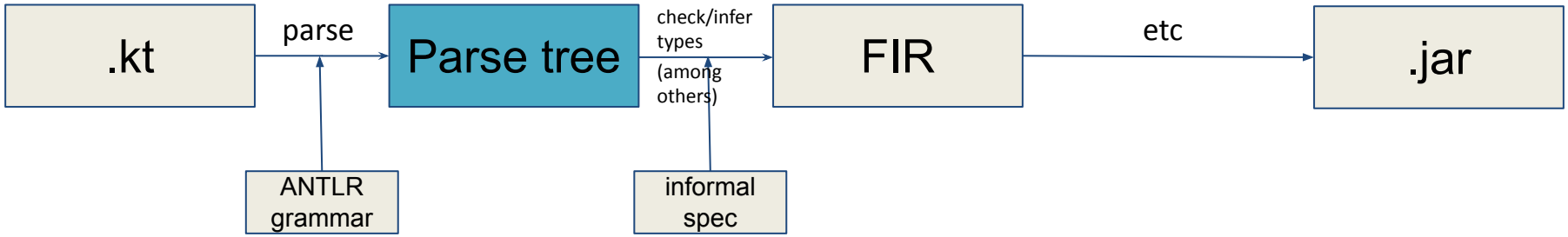
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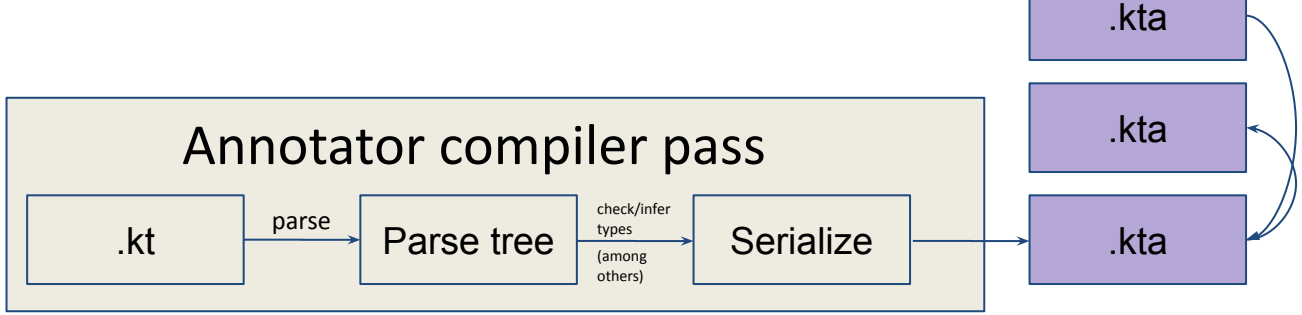
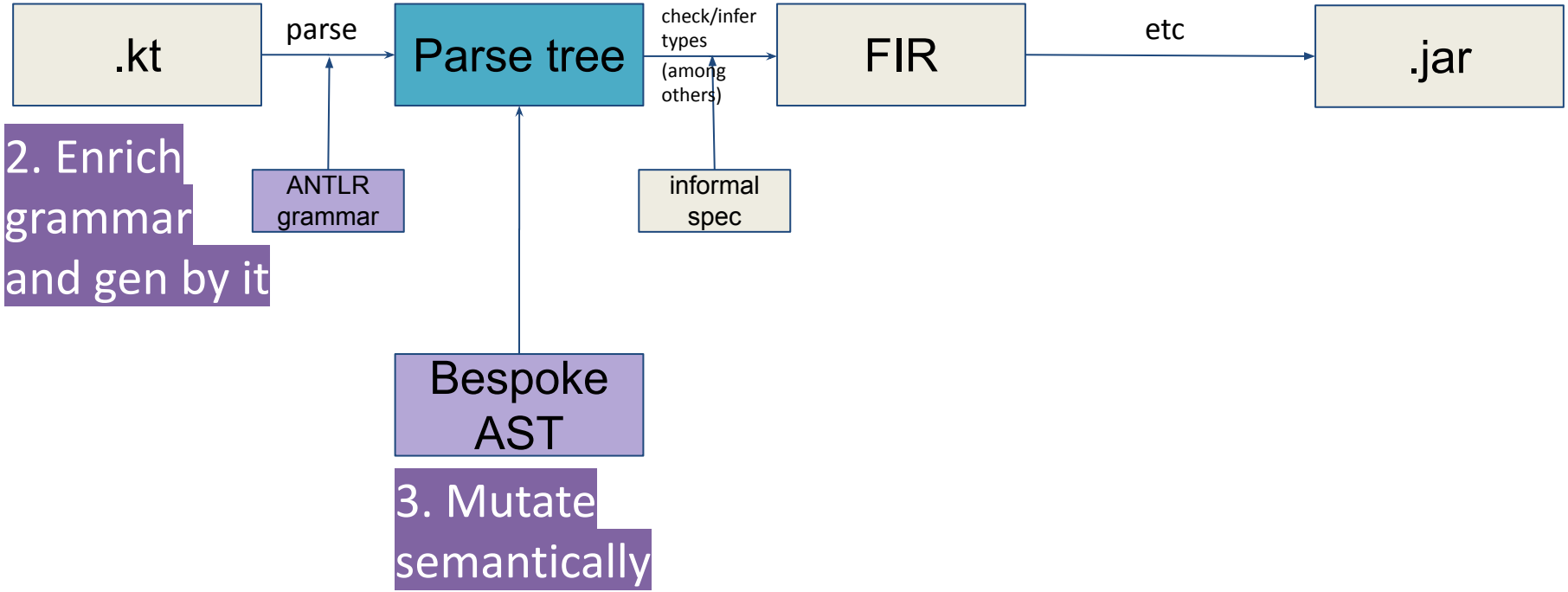
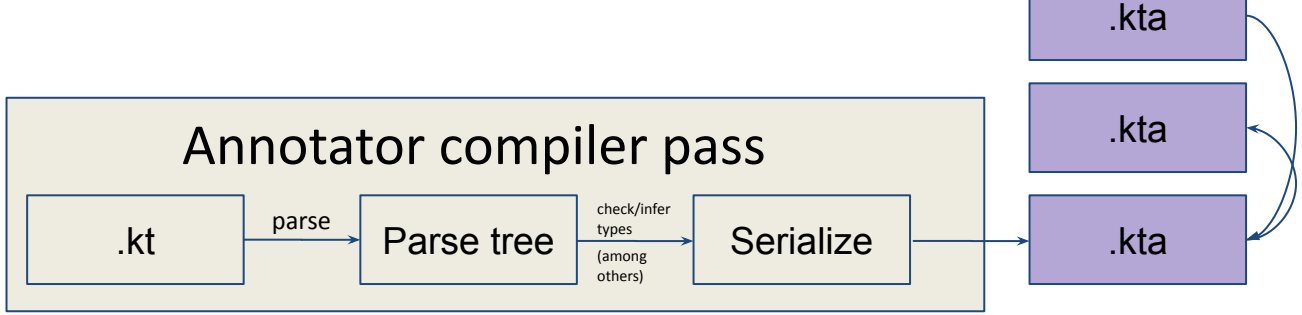


1. “AST” mix & match



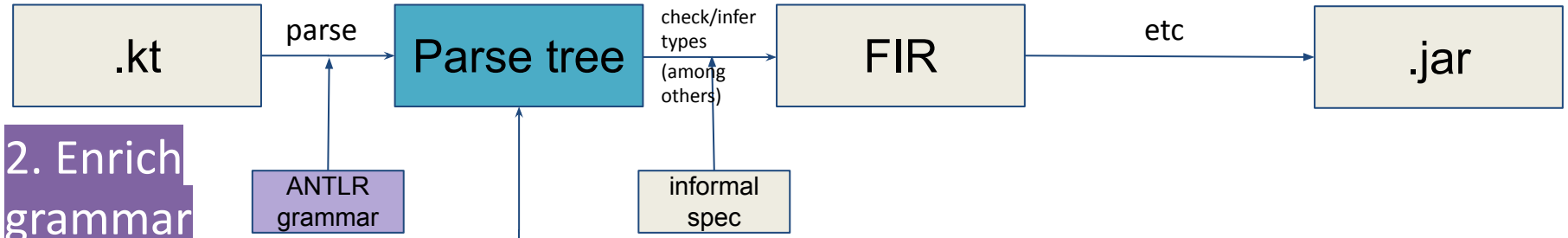
2. Enrich grammar and gen by it

3. Mutate semantically



1. “AST” mix & match

v1 almost there...



2. Enrich grammar and gen by it

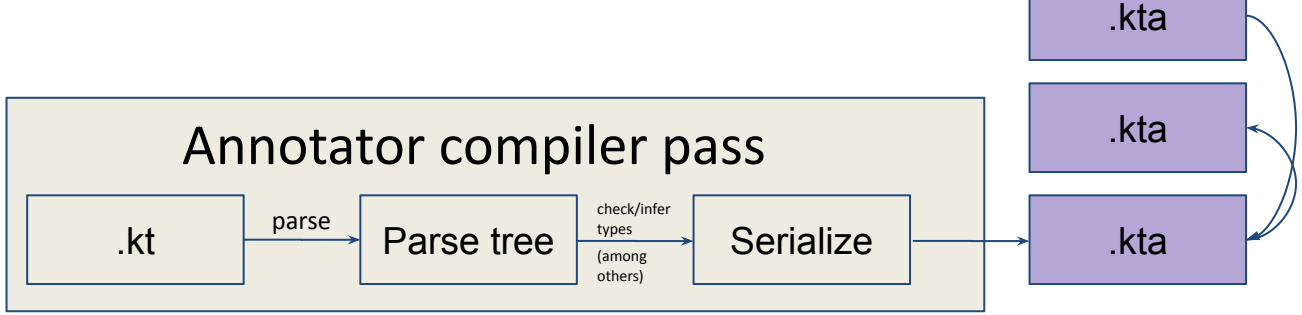
Heuristic+RL approach seems viable (RLcheck)

+DeepSmith experiment

Bespoke AST

3. Mutate semantically

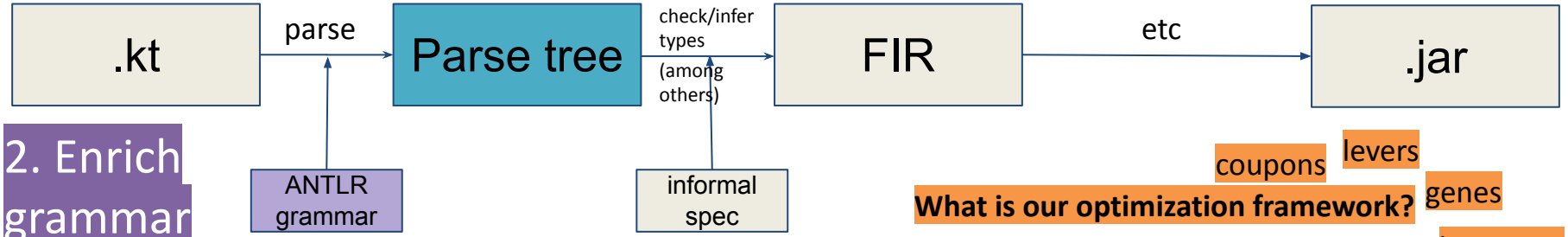
Out of scope this time



Is mixer complete & sound?

1. "AST" mix & match

v1 almost there...



2. Enrich grammar and gen by it

"gen"

Heuristic+RL approach seems viable (RLcheck)

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How much expert effort to enrich?

How do we schedule seeds?

How cheap is useful instrumentation?

How do we measure perf?

coupons

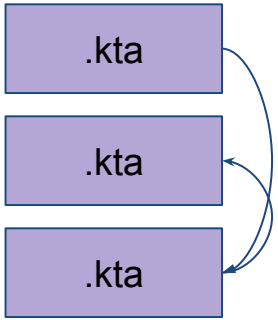
levers

What is our optimization framework?

genes

heuristics

bayesian updates



Novelty: semantic performance fuzzer +RL

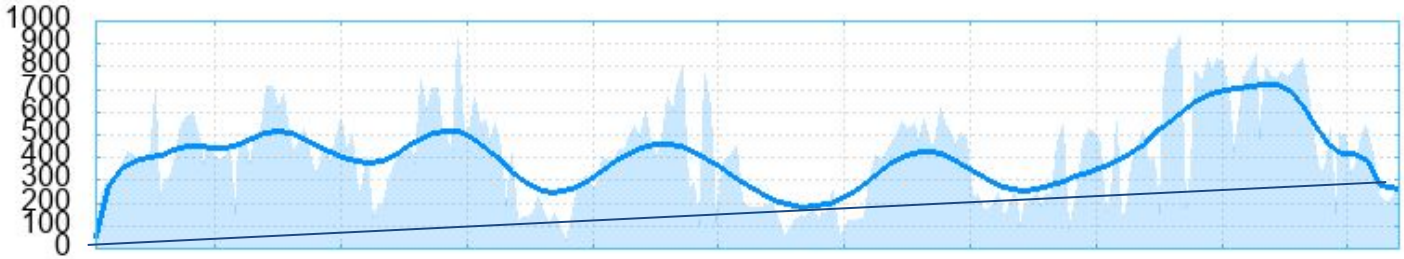
1. “AST” mix & match

v1 almost there...

TBD: name mangling, integrate upstream patch

8h

WIP report



Threats

- Kotlinc is *slow* (100 op/sec clear, 5 op/sec instrumented)
- Dataset (= compiler tests) incomplete
- Semi-blackbox model => useless rewrites
- Naive perf convergence assumptions
- No shrinking
- Unclear reusability

2. Enrich grammar and gen by it

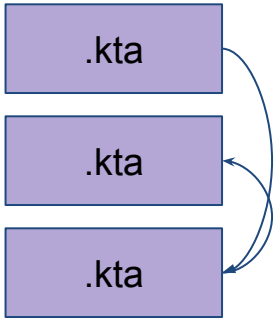
scale

parse github

heuristics

generalize

reuse prior JBR work



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WIP report

wldhx@wldhx.me, victor.petukhov@jetbrains.com

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