BinCAT

Purrfecting binary static analysis

June 16th 2017 - REcon

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AIRBUS

Plan

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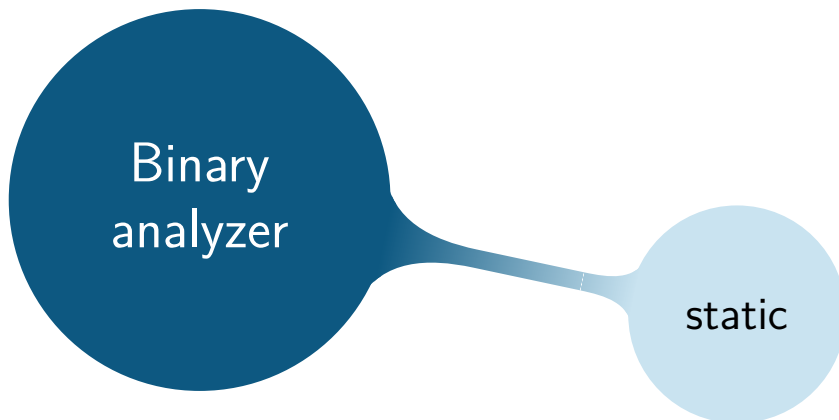

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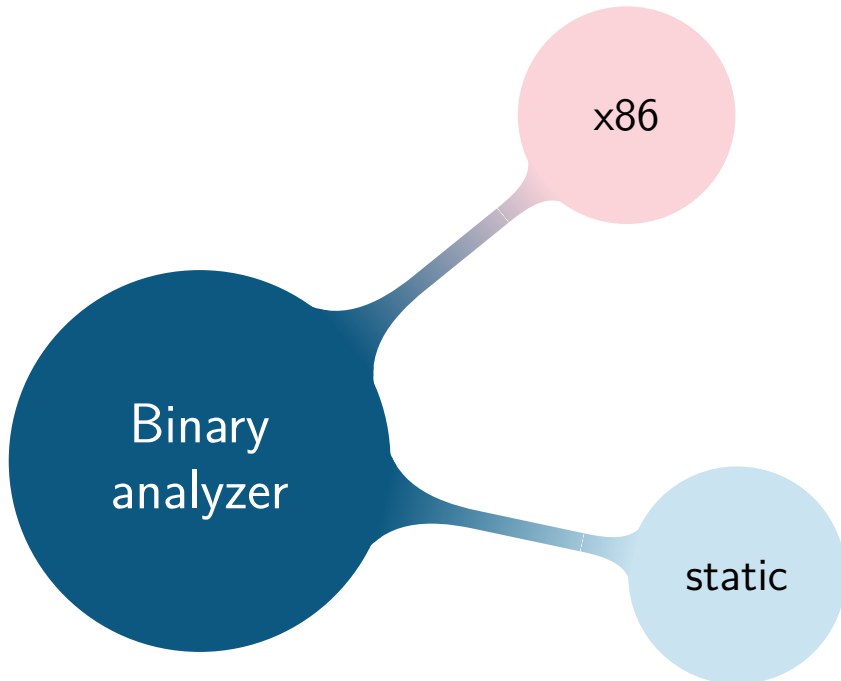

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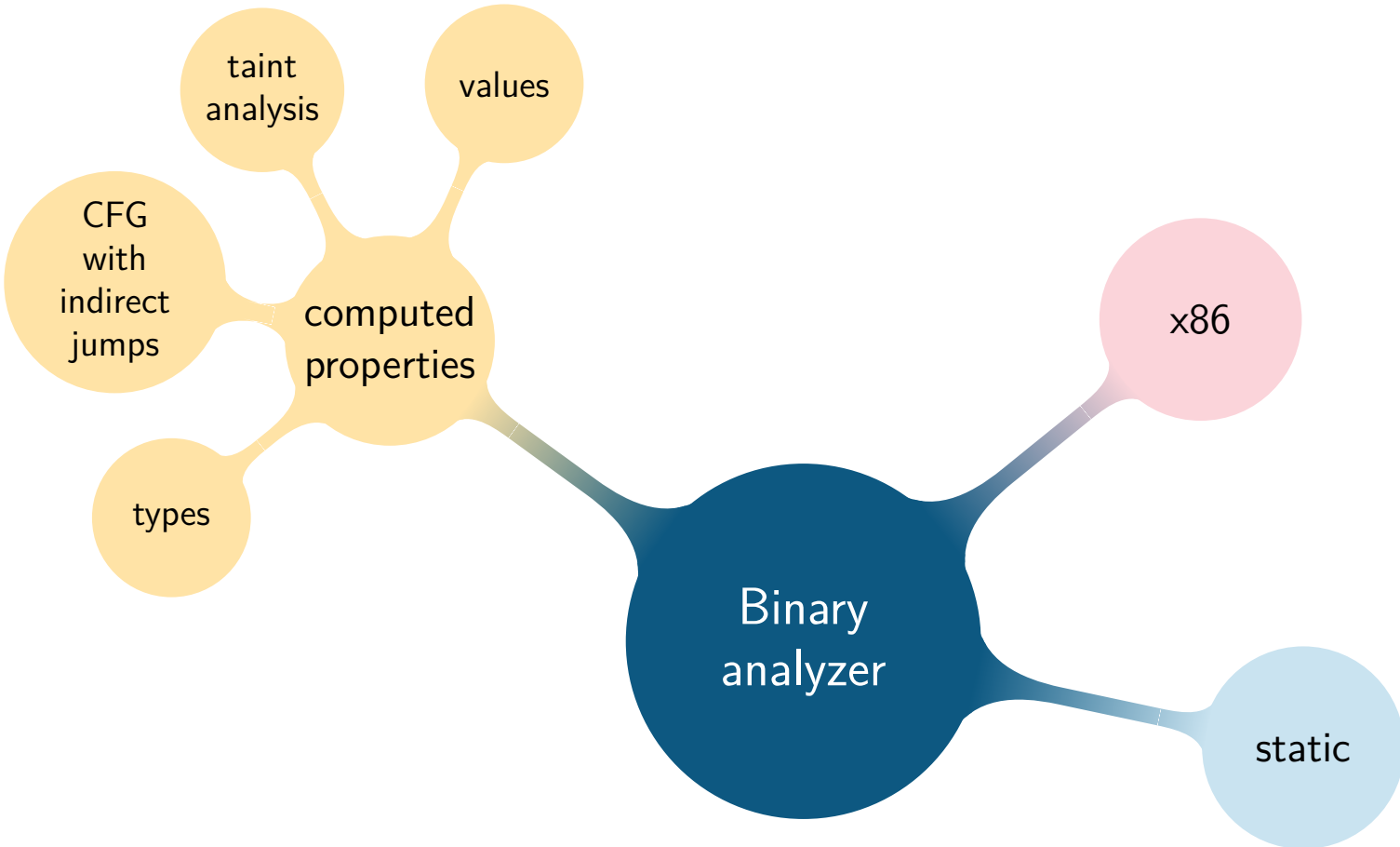

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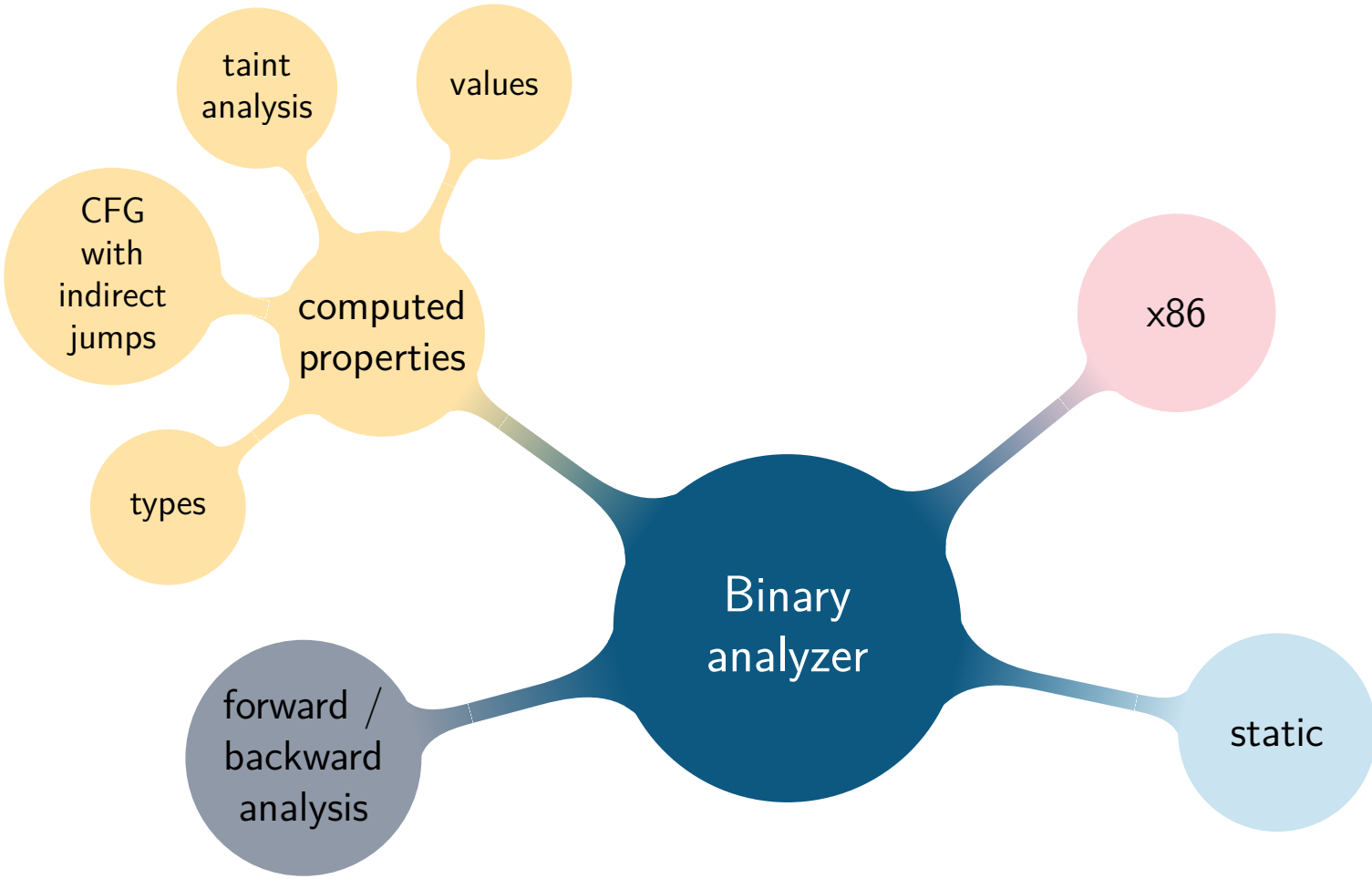

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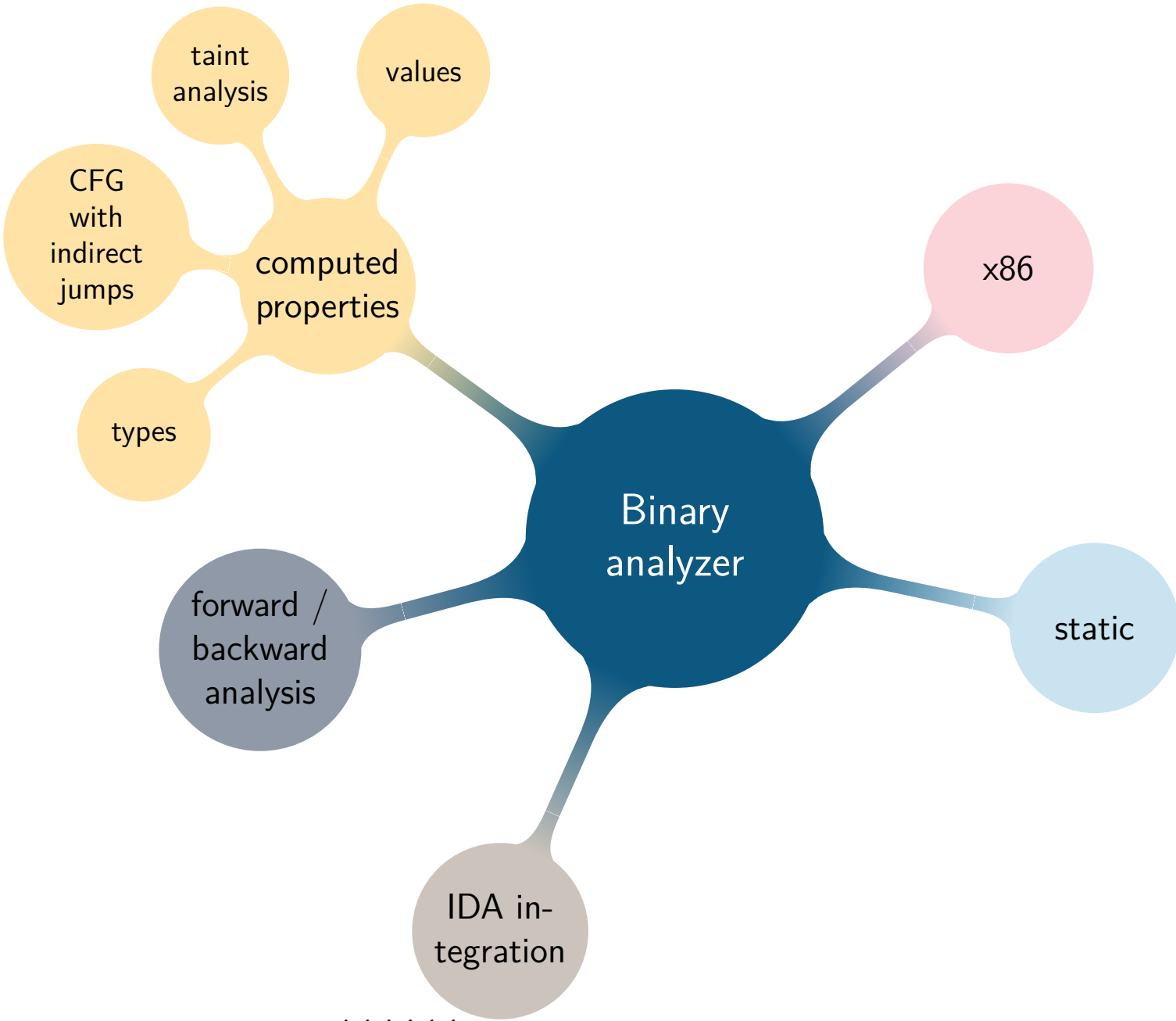

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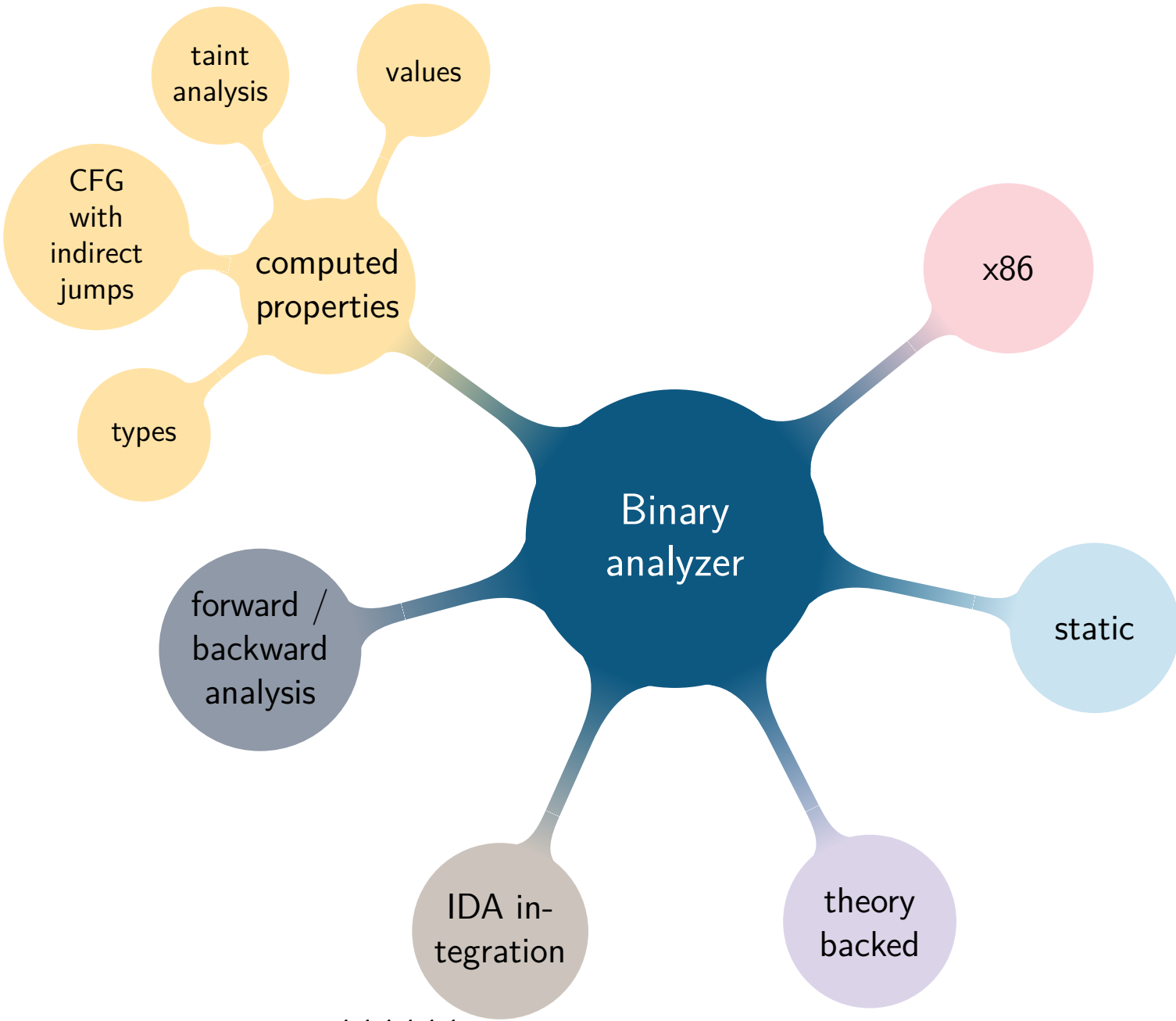

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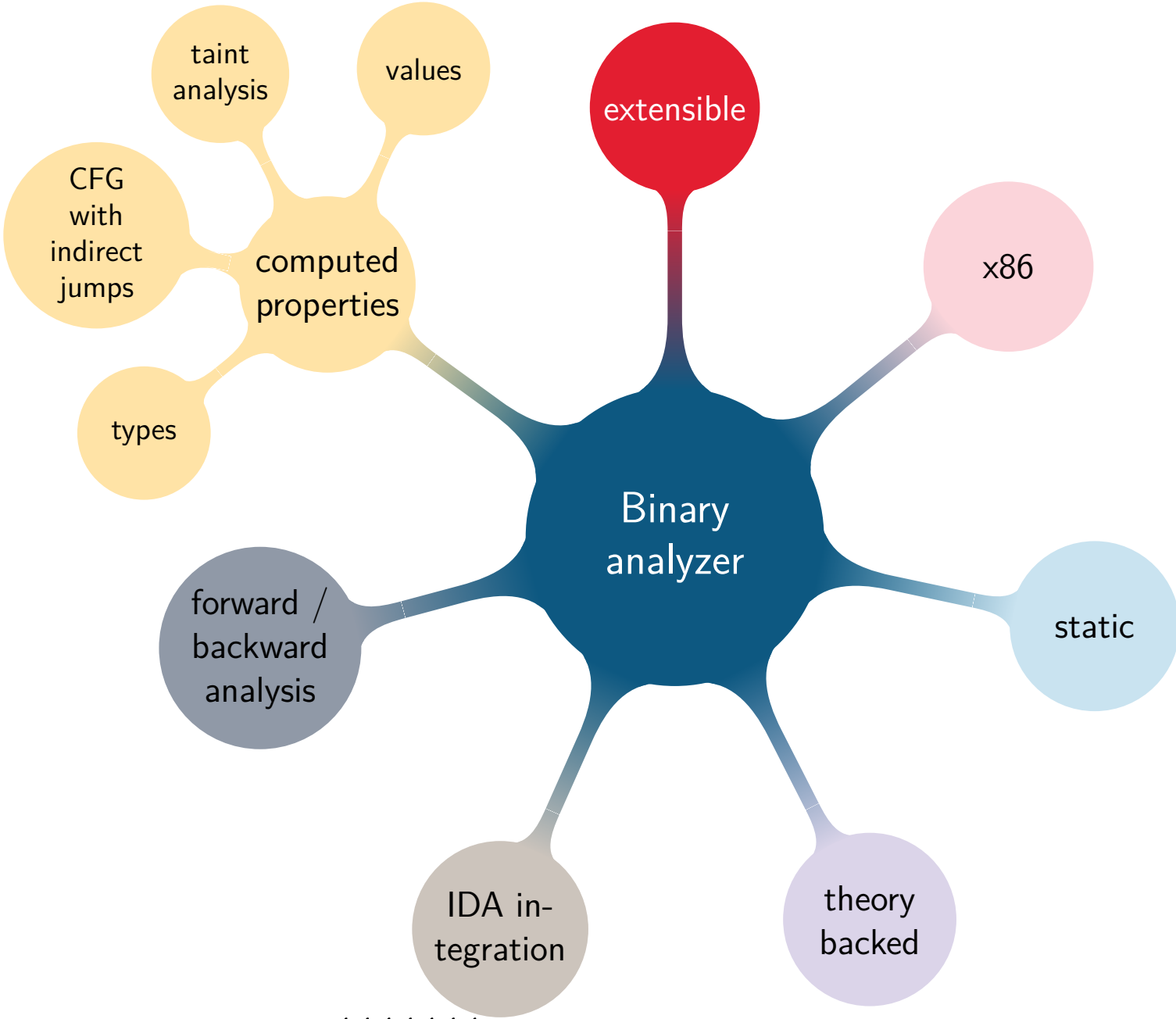

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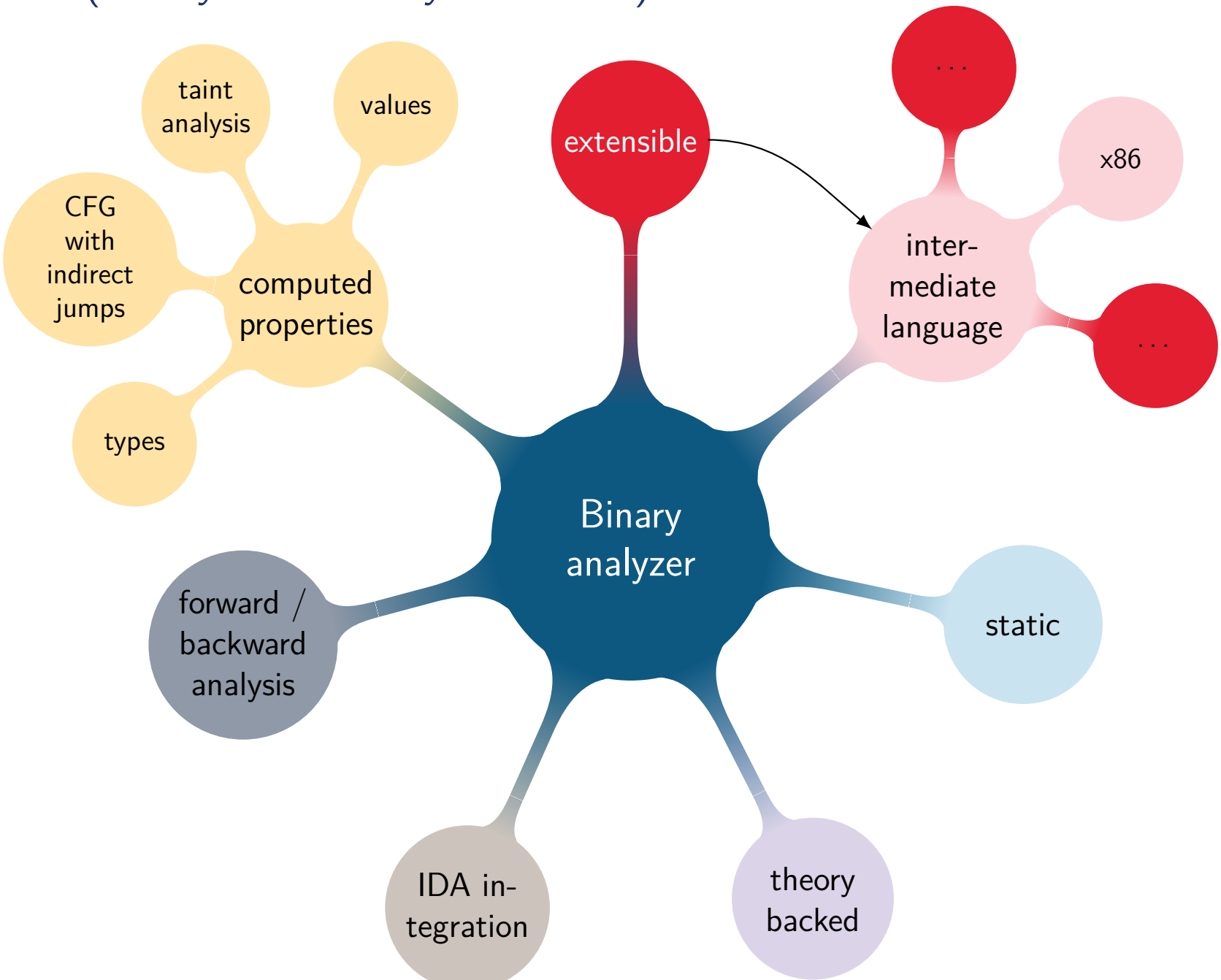

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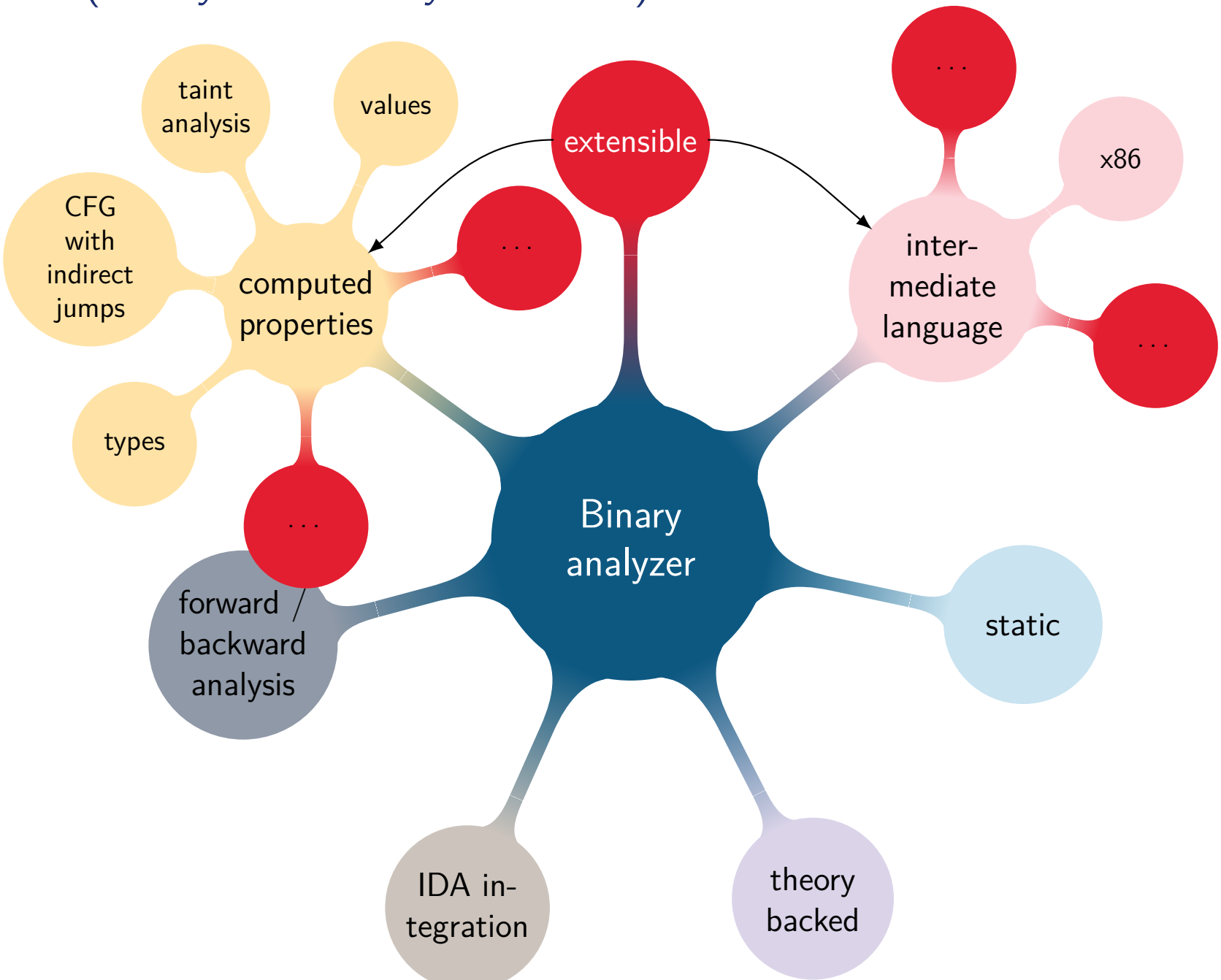

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Example: keygenme

```
$ ./get_key
Usage: ./get_key company department name licence
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Licence=>[025E60CB08F00A1A23F236CC78FC819CE6590DD7]
Thank you for registering !
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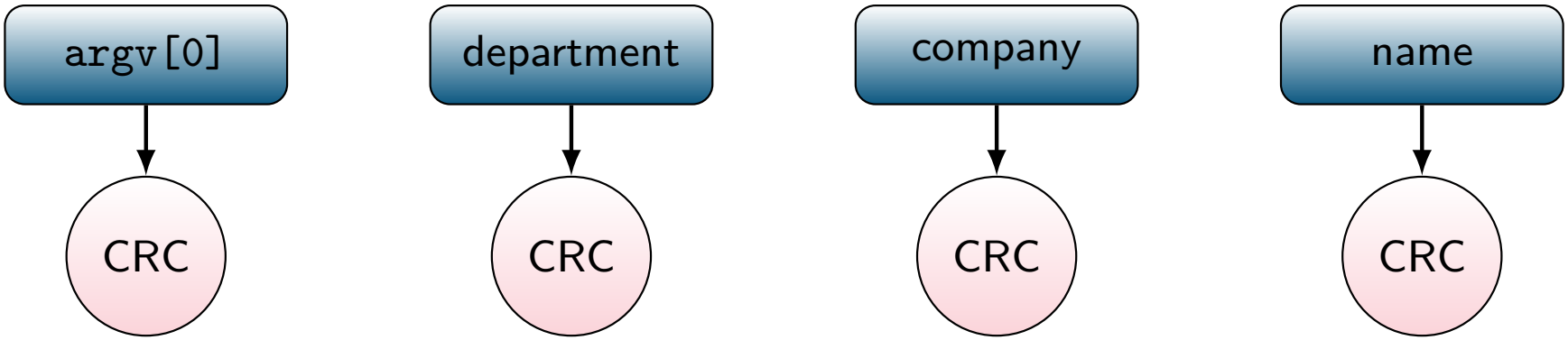

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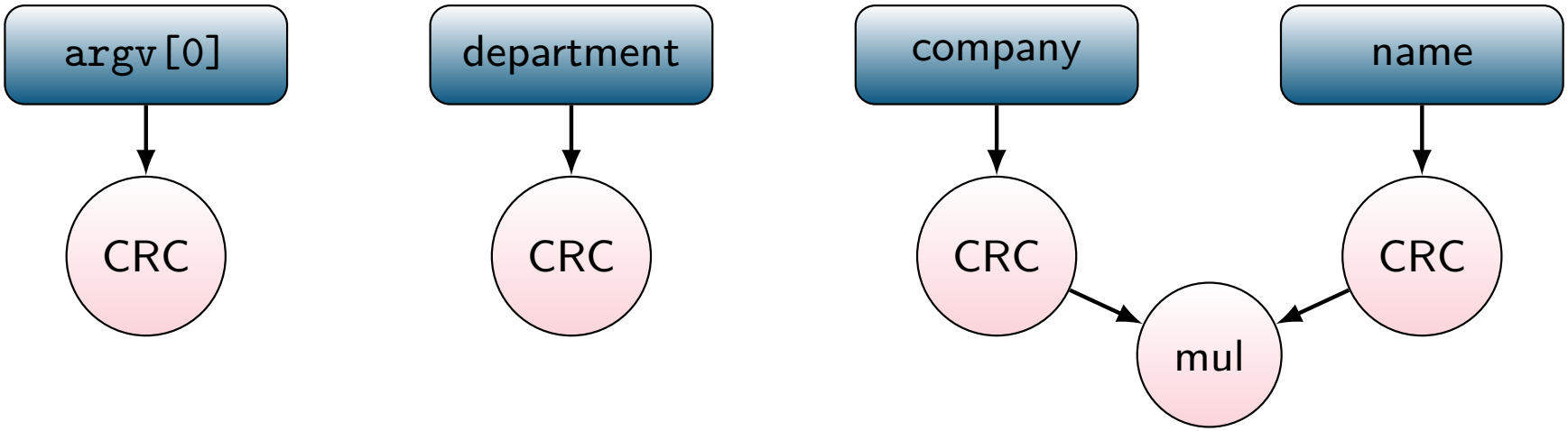

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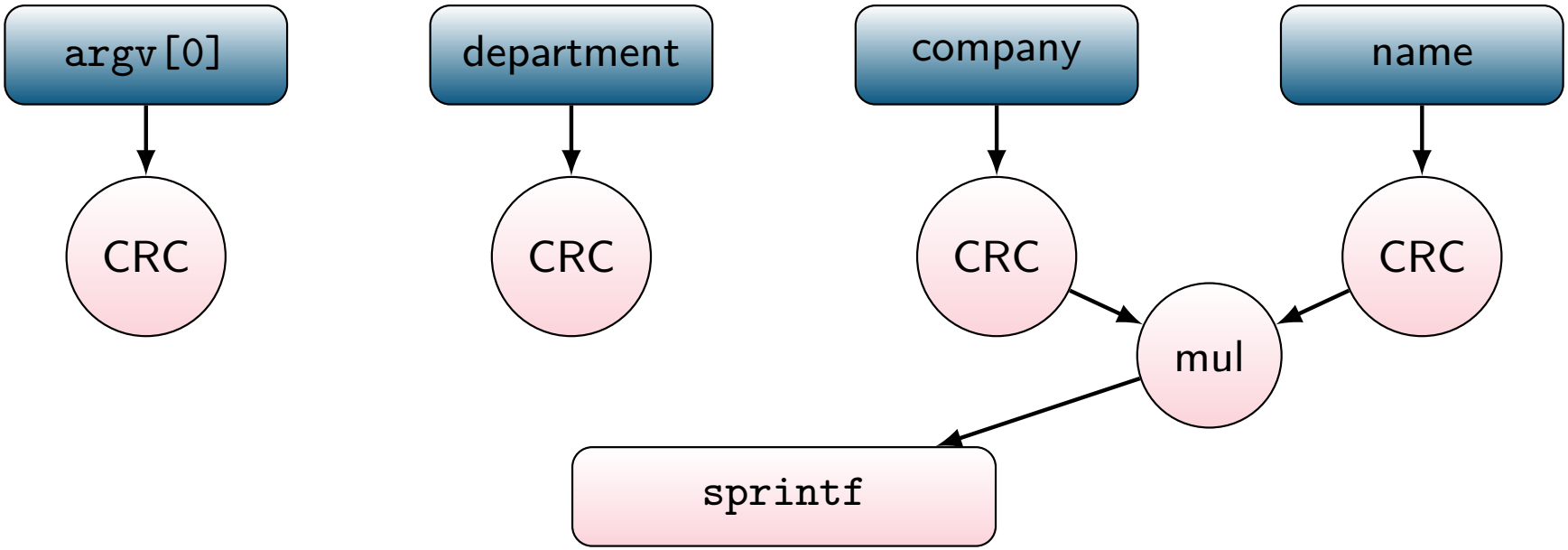

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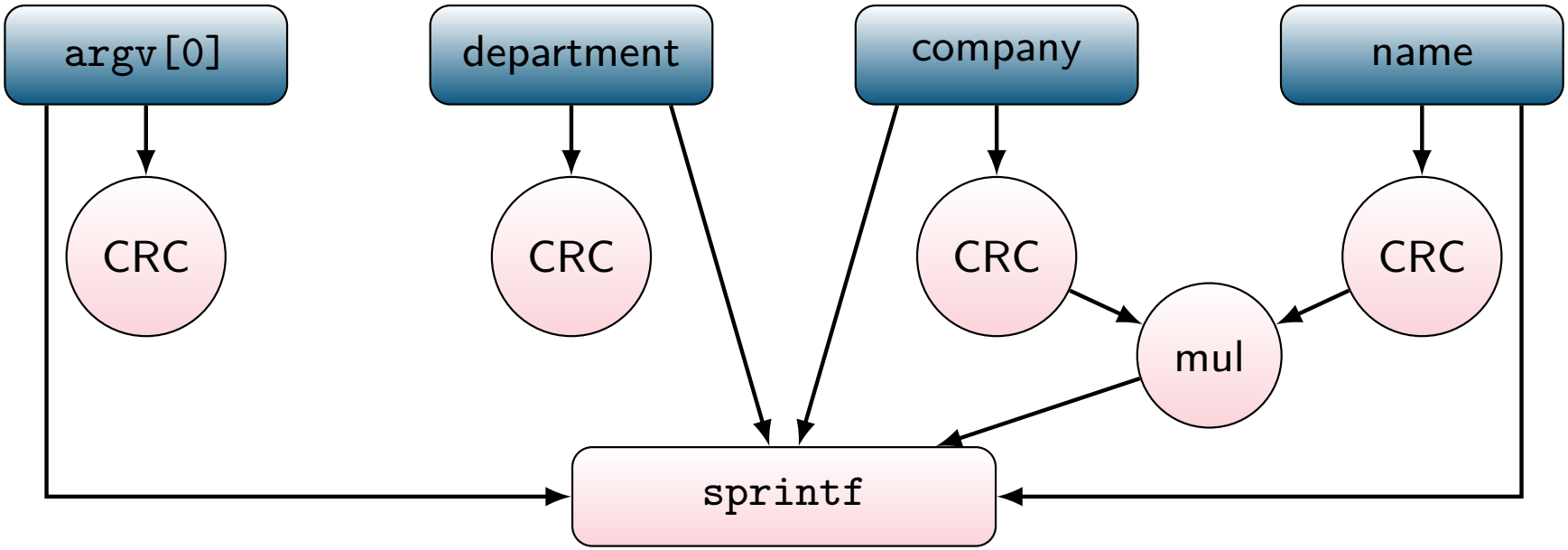

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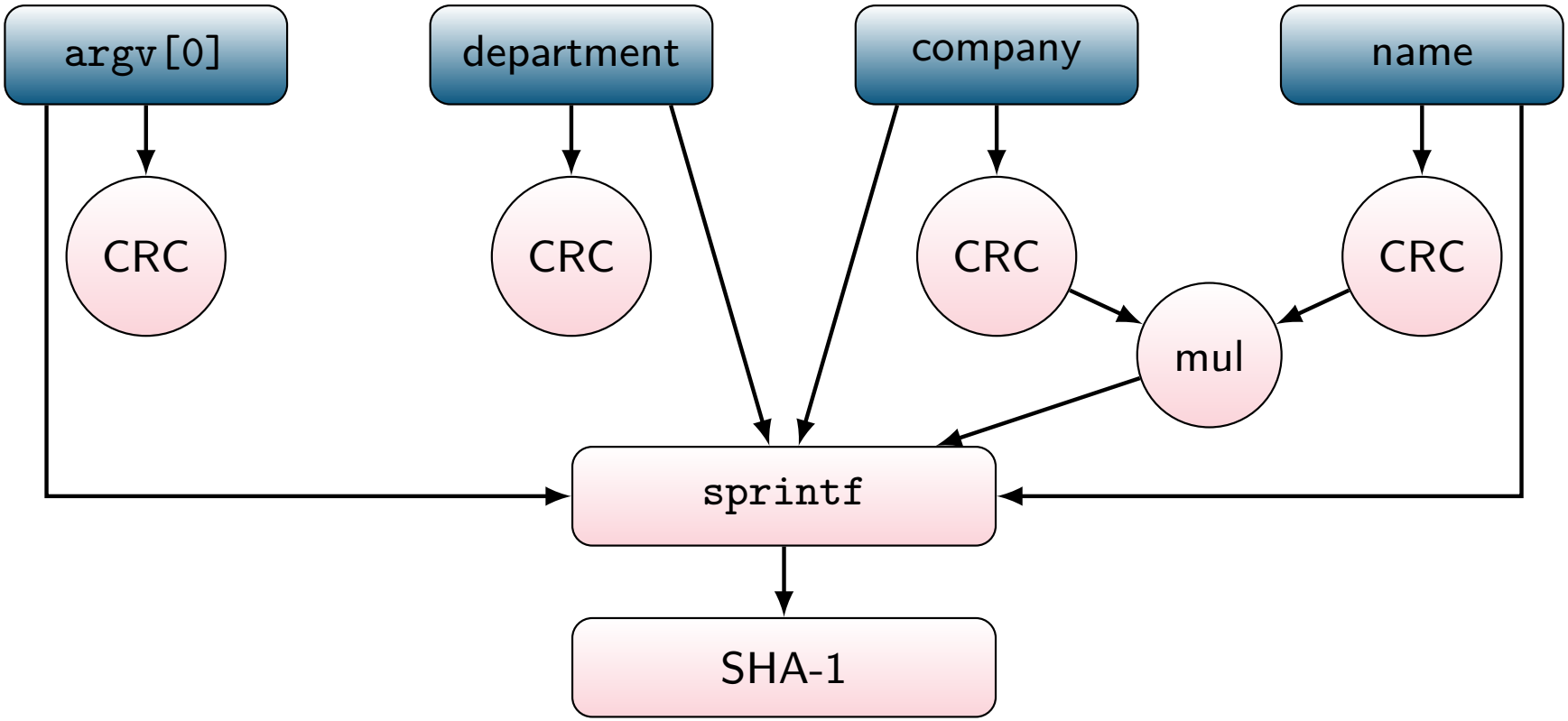

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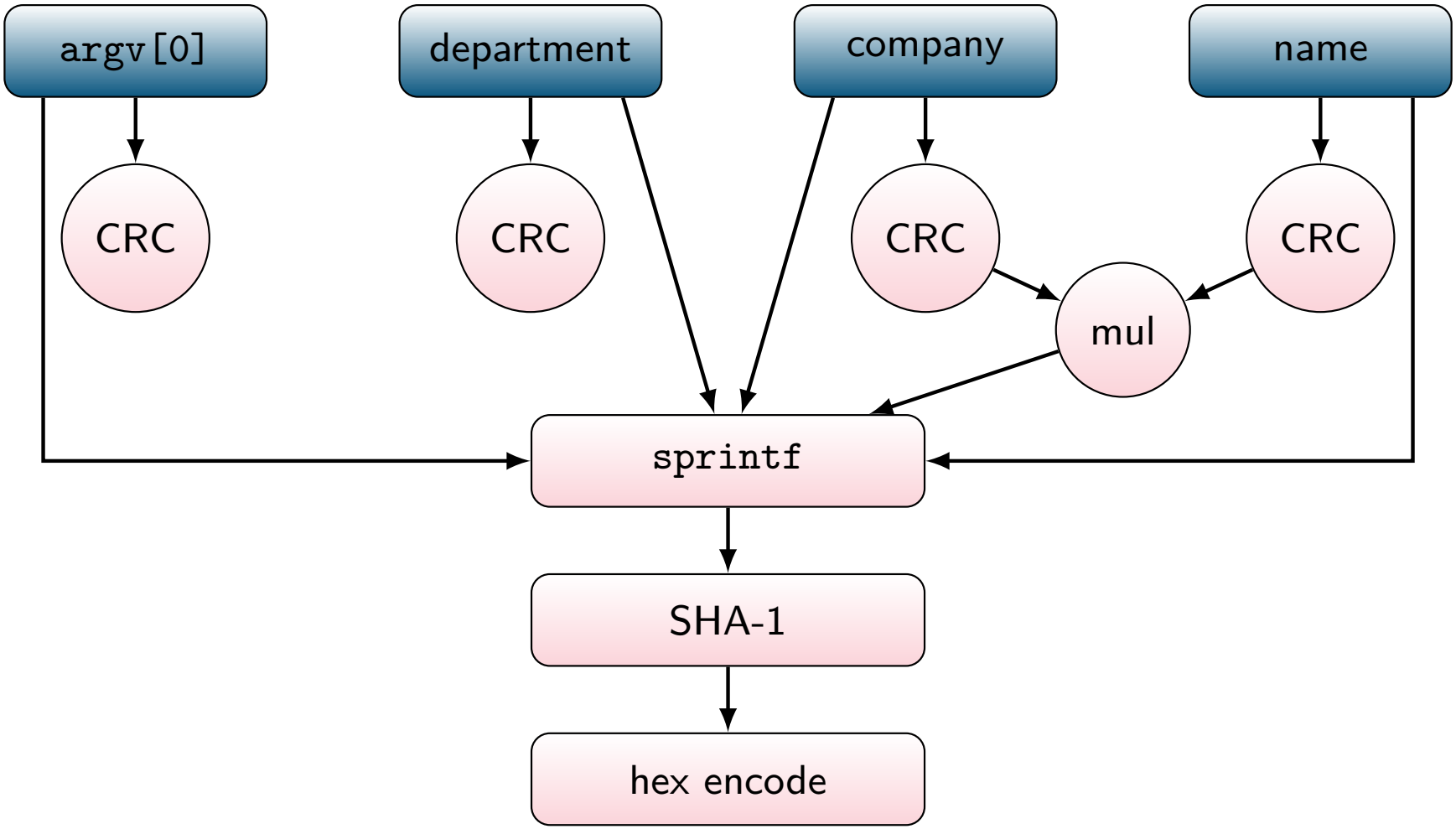

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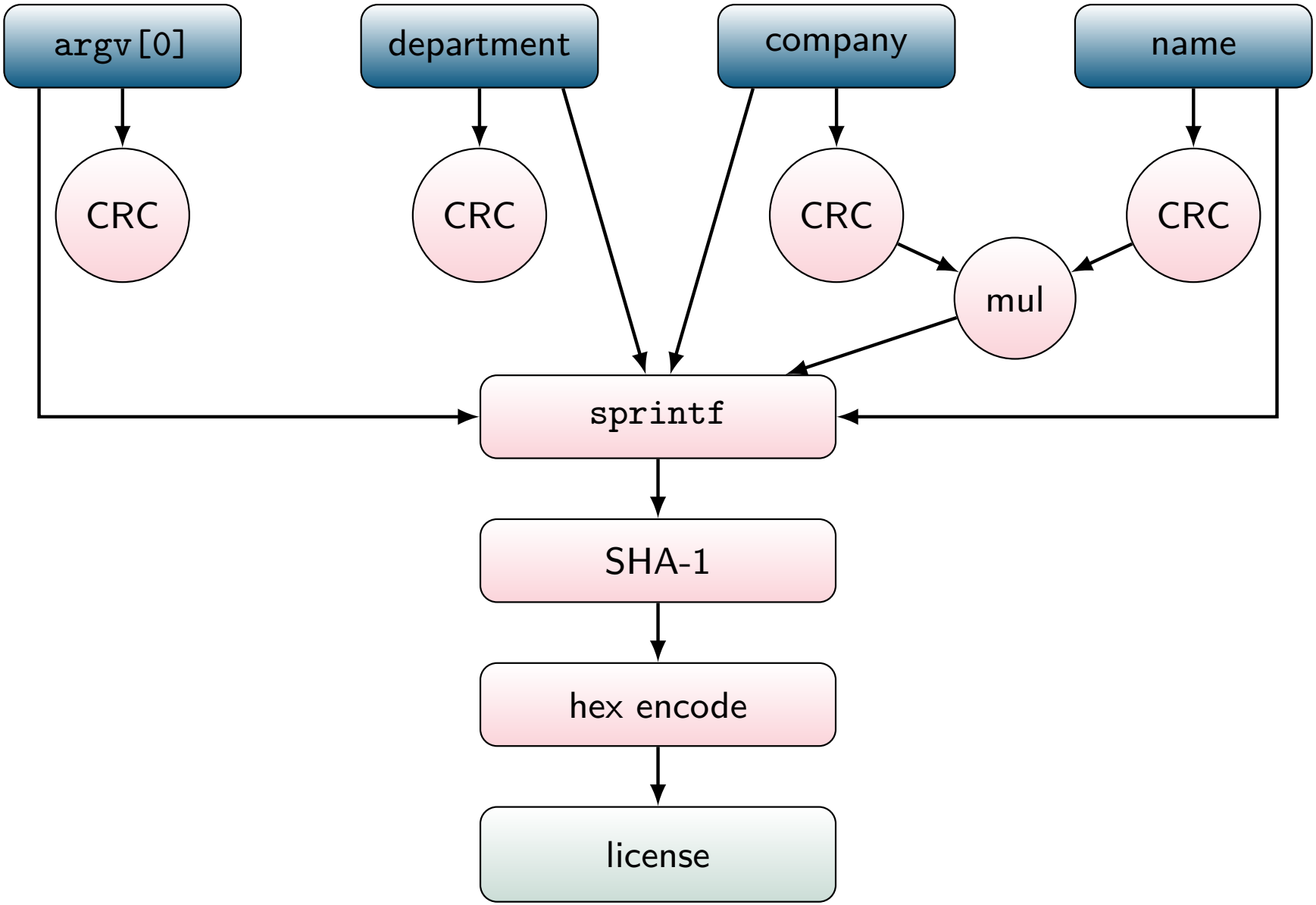
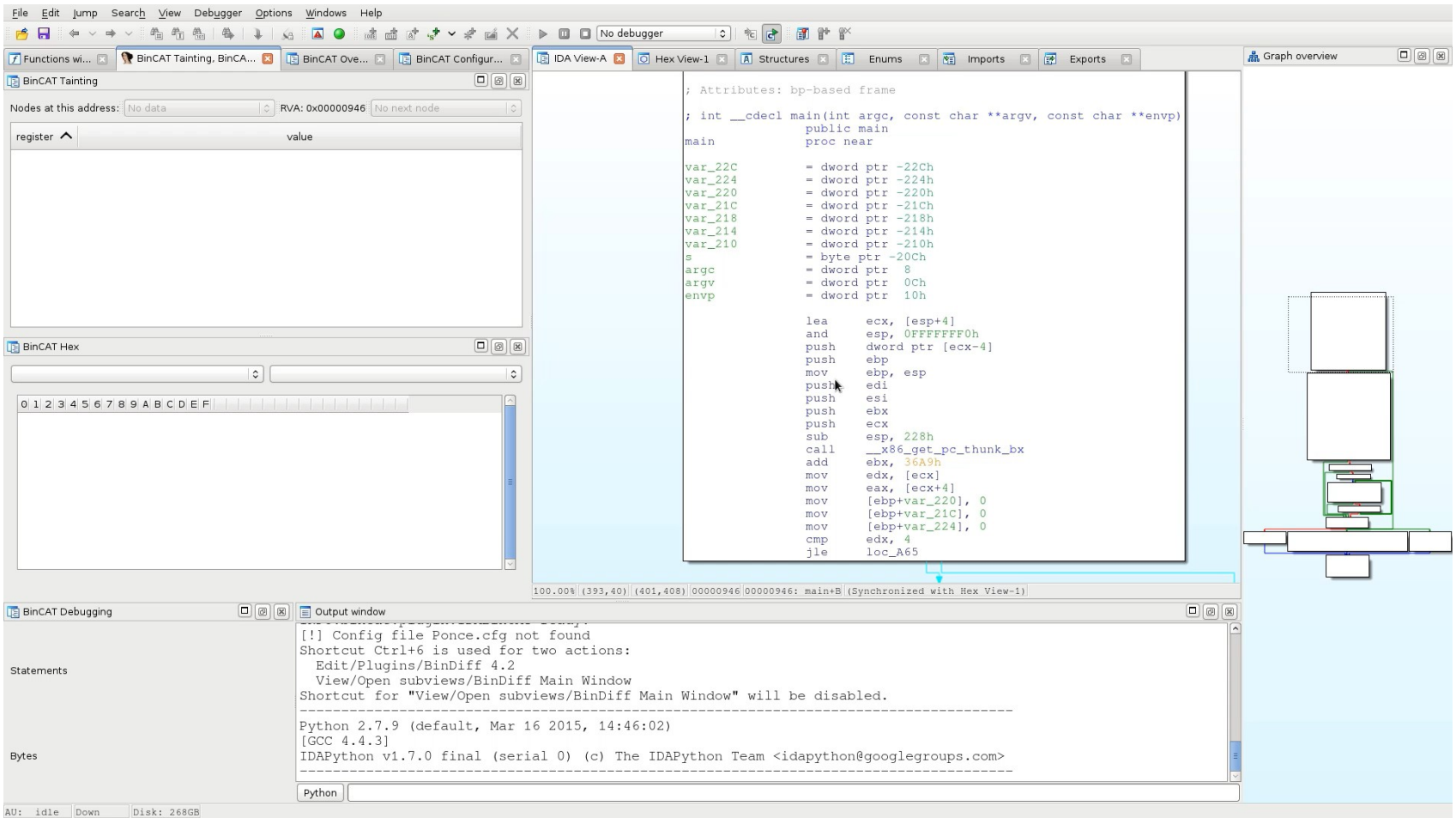
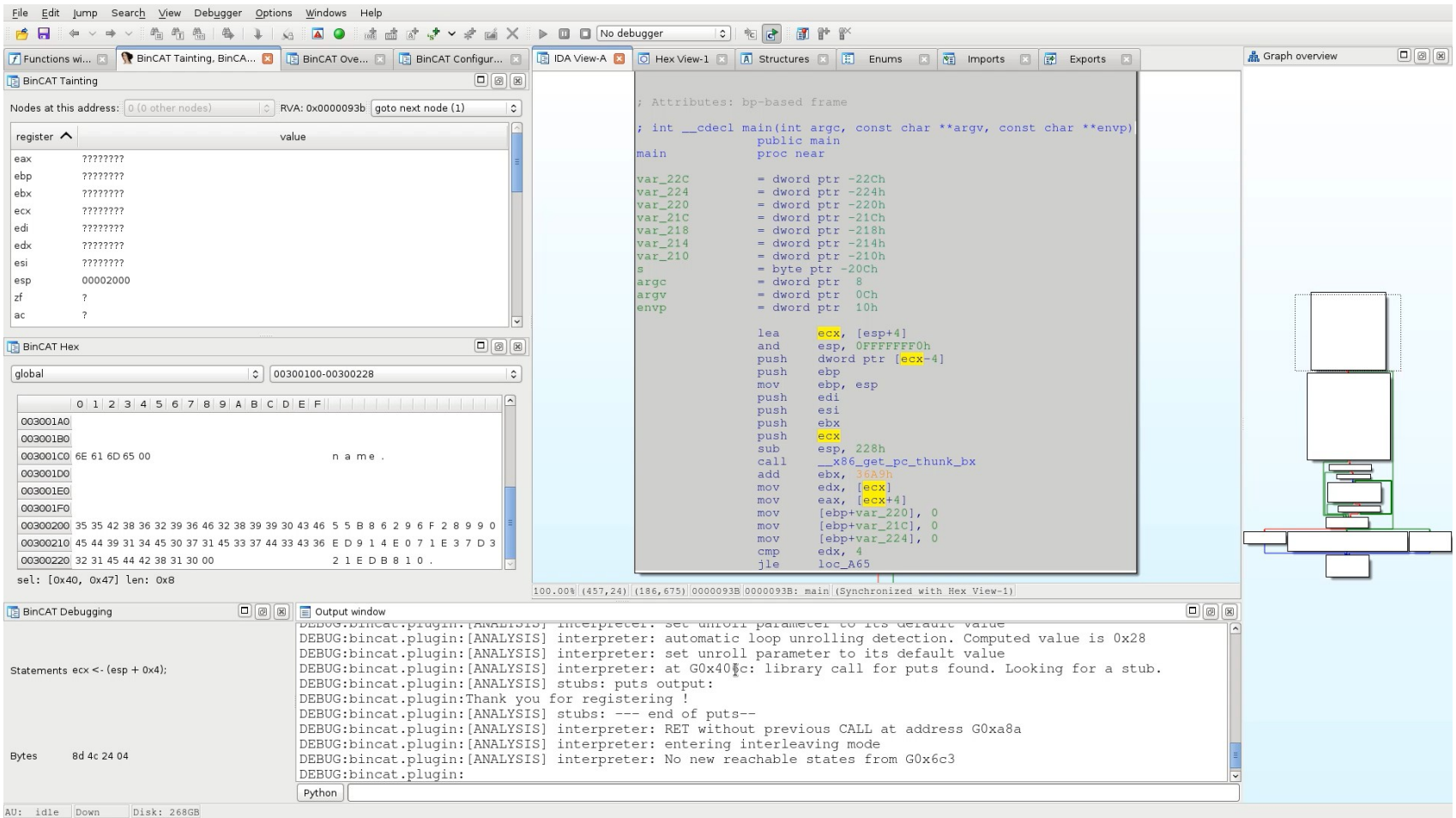


Demo 1: BinCAT usage

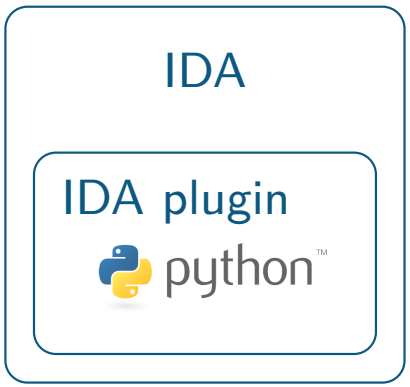


Demo 2: Tainting



Plan

Architecture



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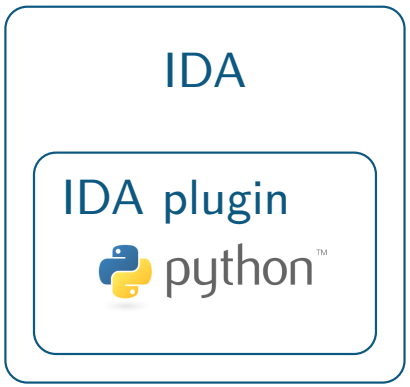

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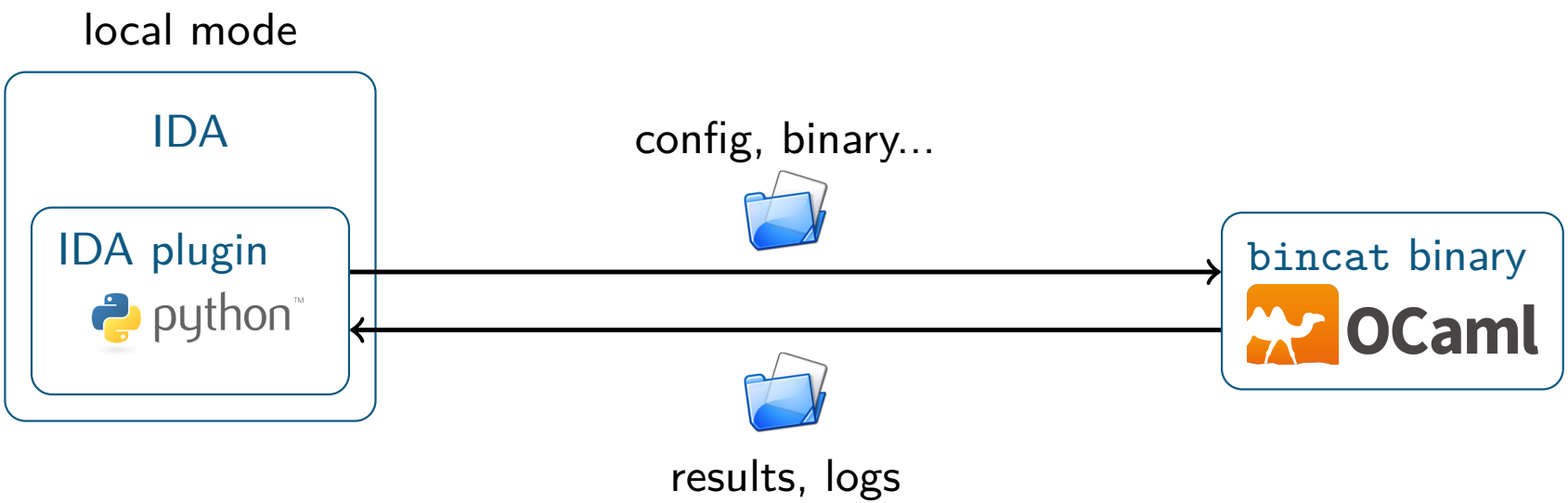

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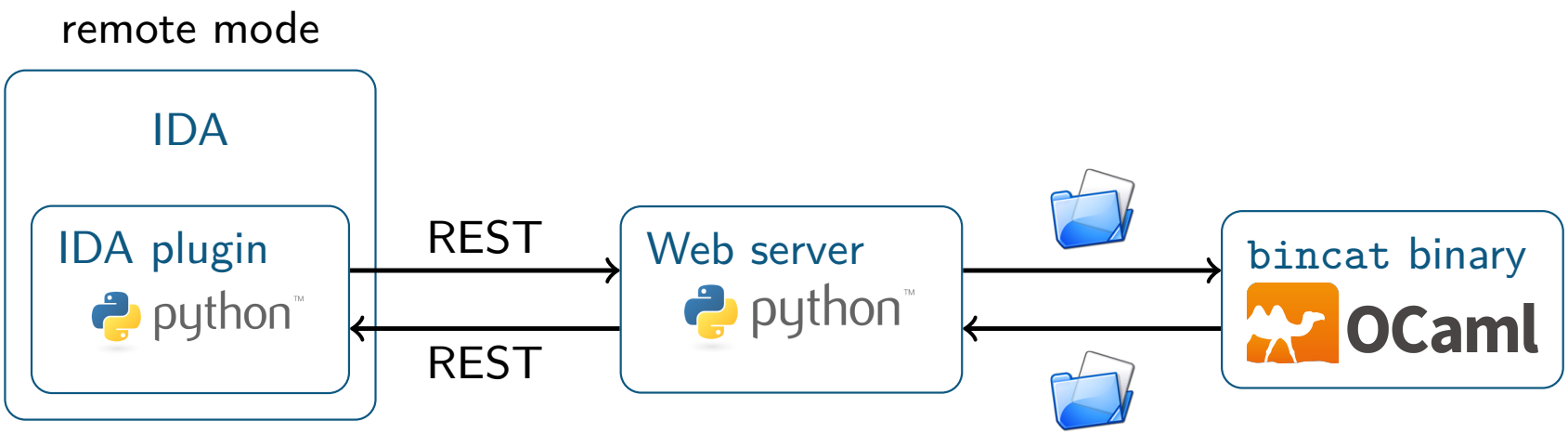

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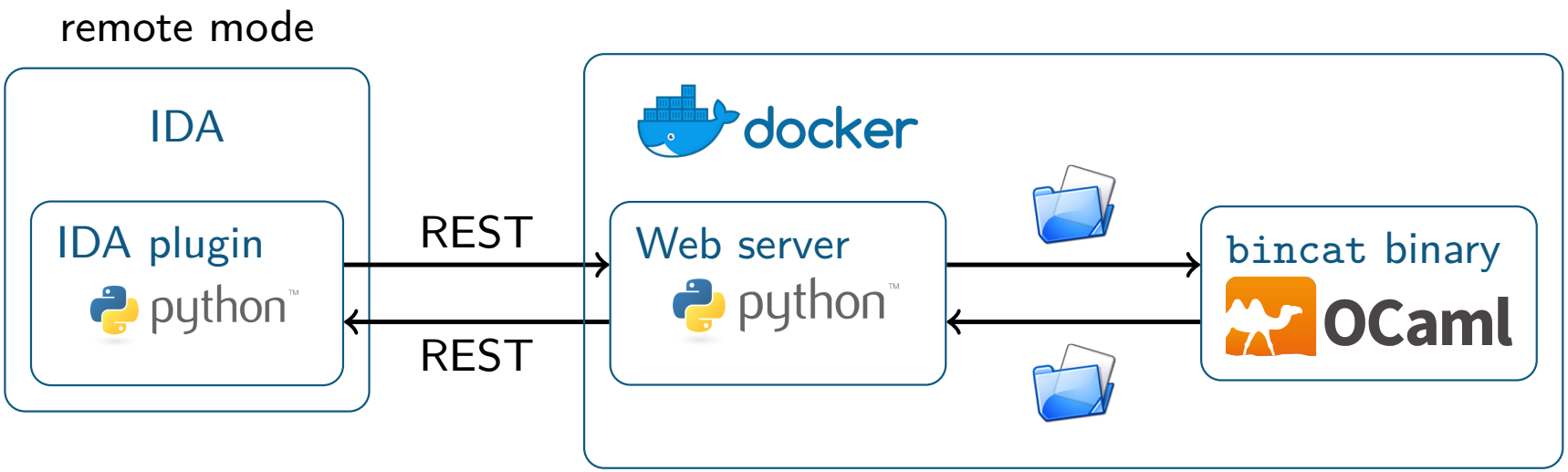
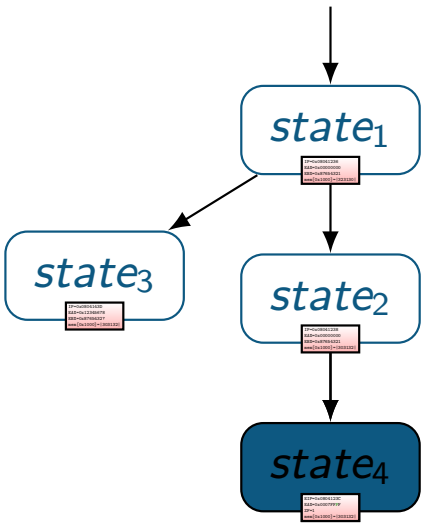


Control flow graph reconstruction



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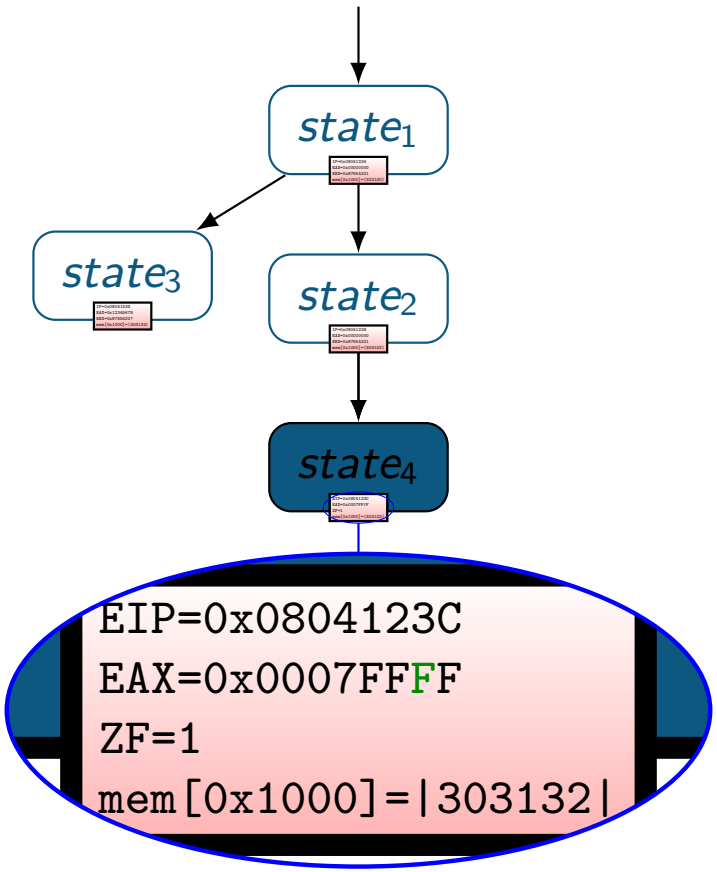

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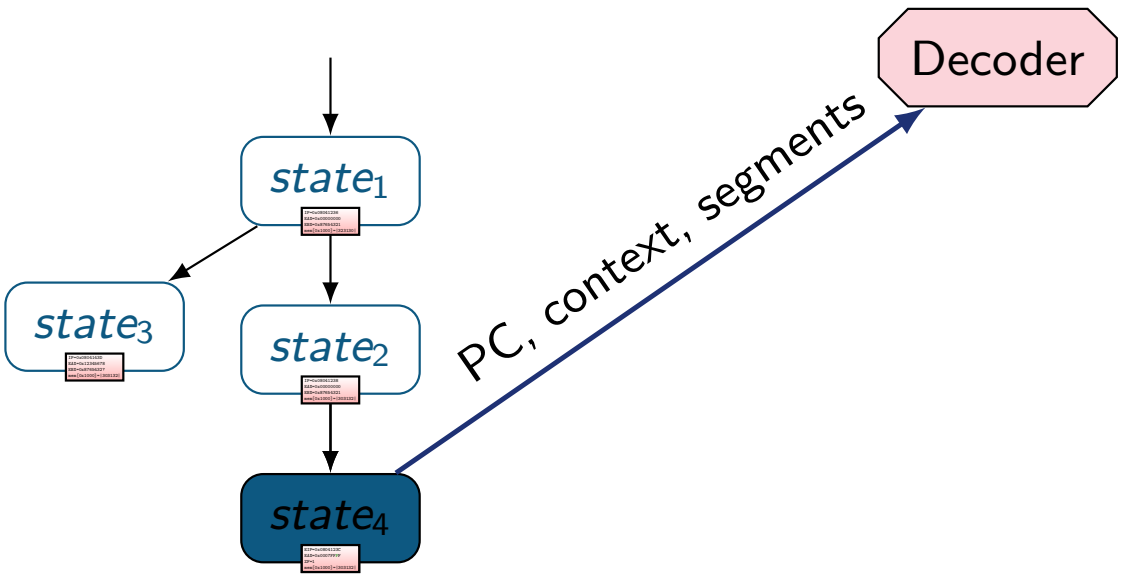

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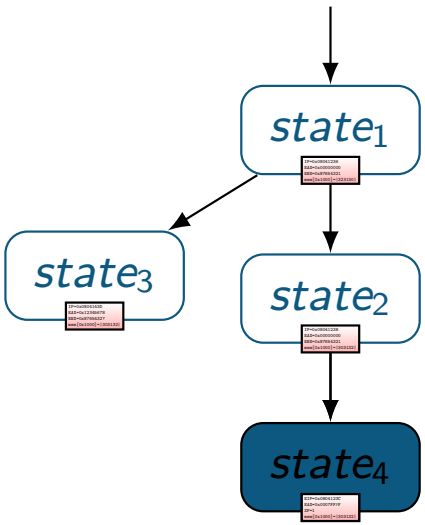

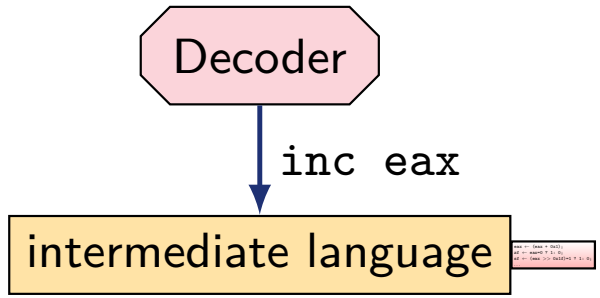

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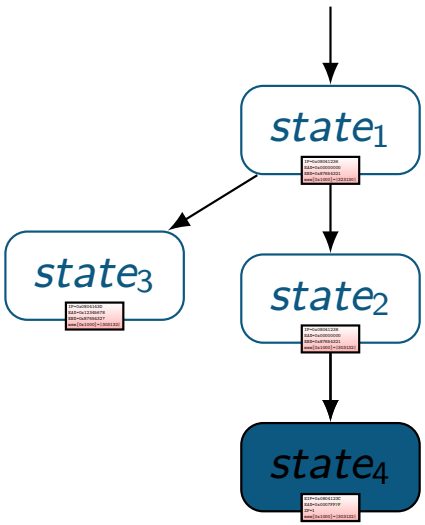

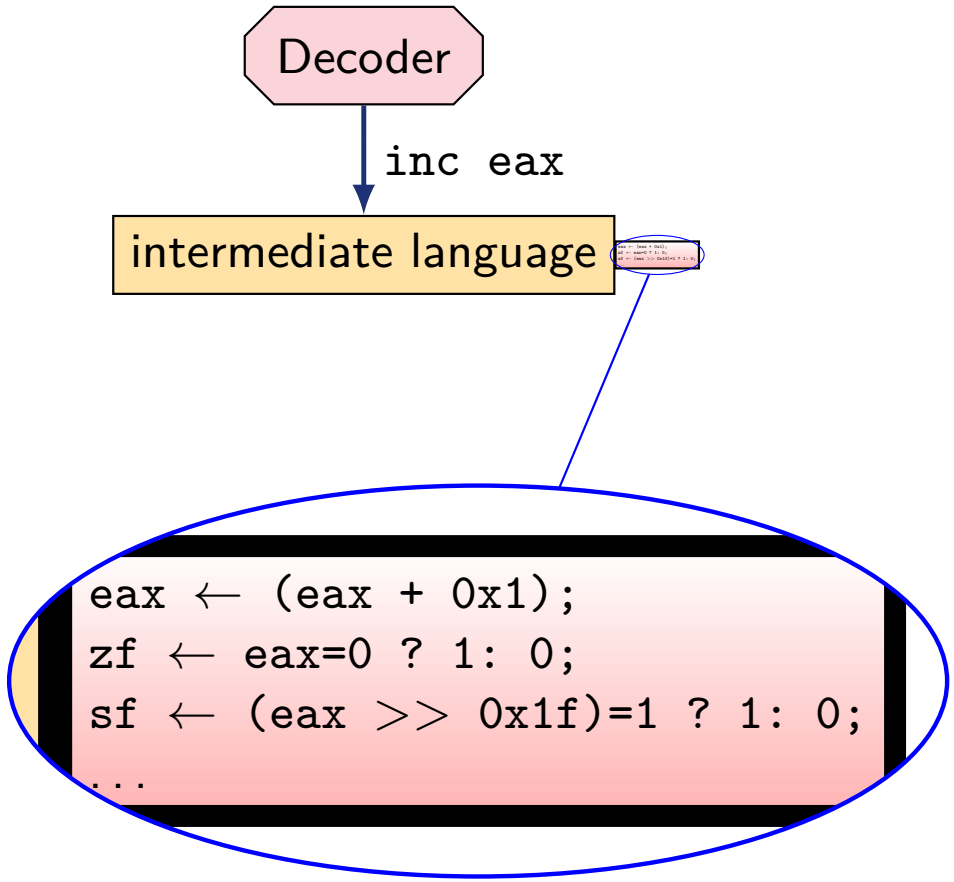

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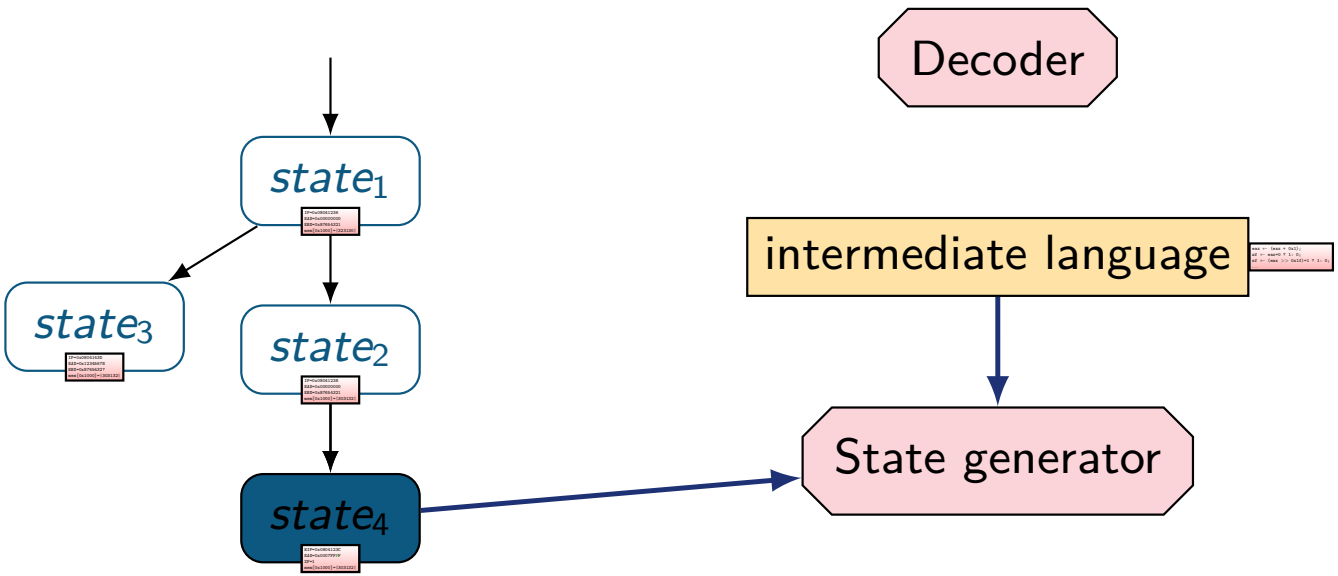

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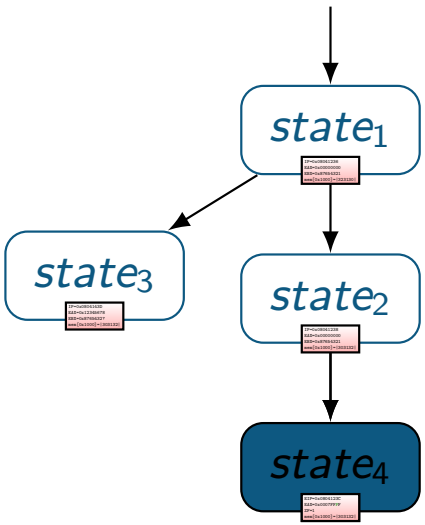

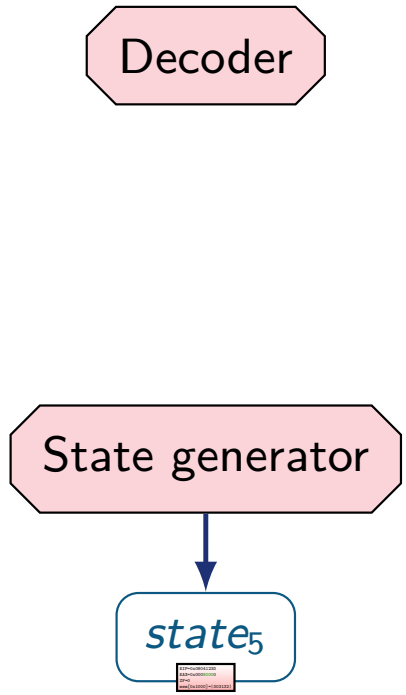

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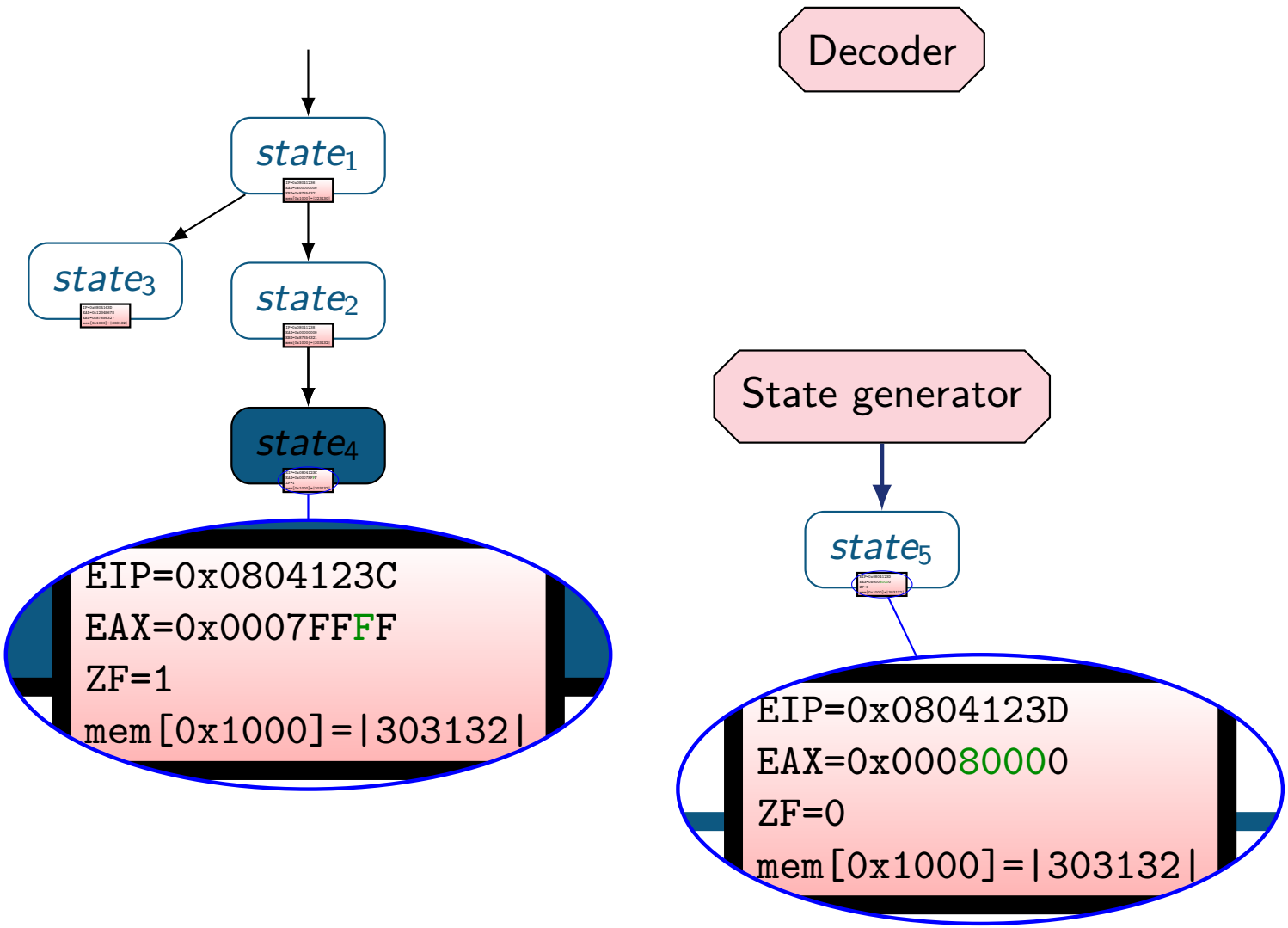

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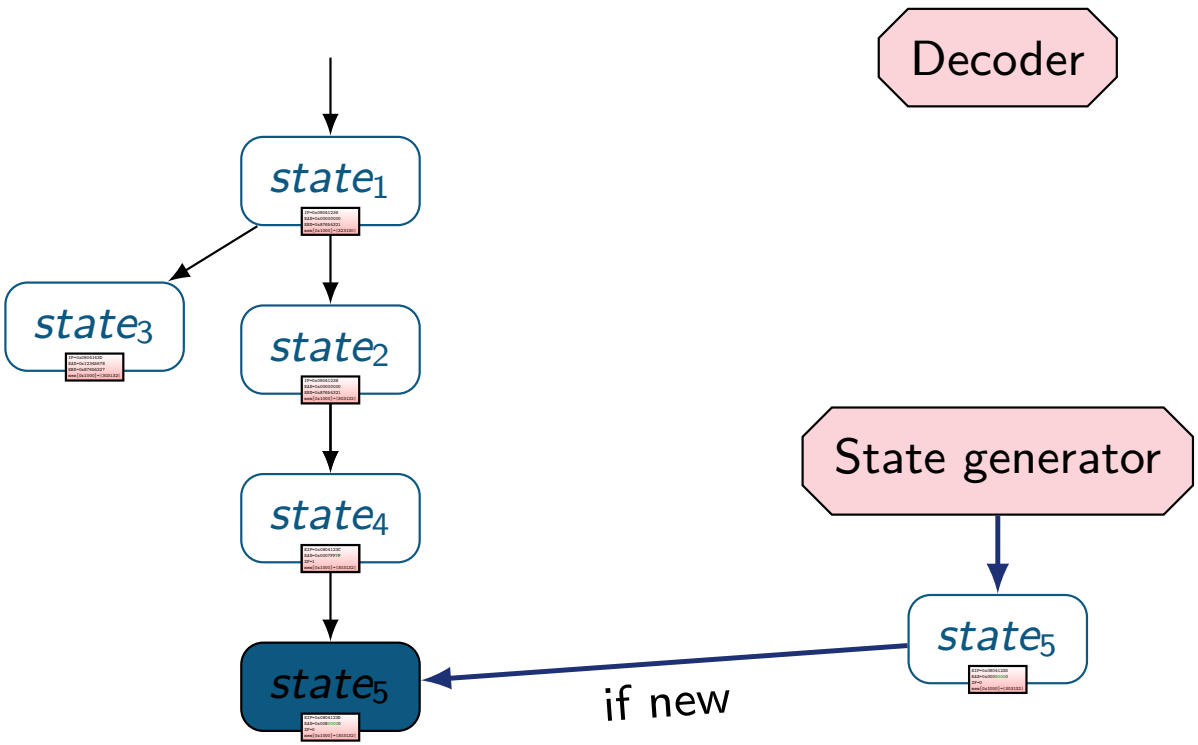

Formal correctness: static analysis by abstract interpretation

- operations on values/taint/types are done on *abstract* objects which represent sets of values/taint/types
  ex: $0 \equiv \{0\}$, $? \equiv \{\text{integers}\}$, $\text{Struct} \equiv \{\text{C structs}\}$
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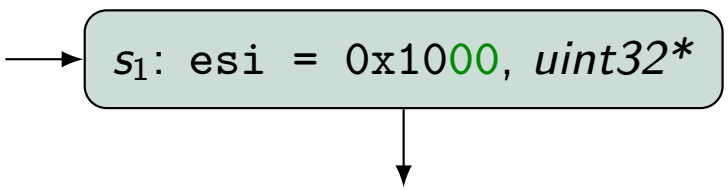

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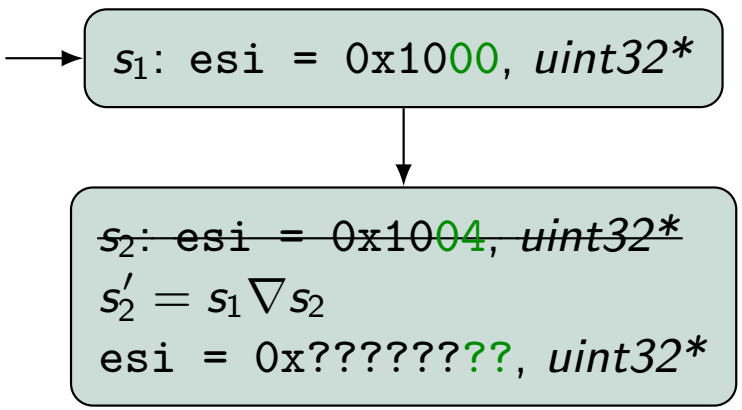

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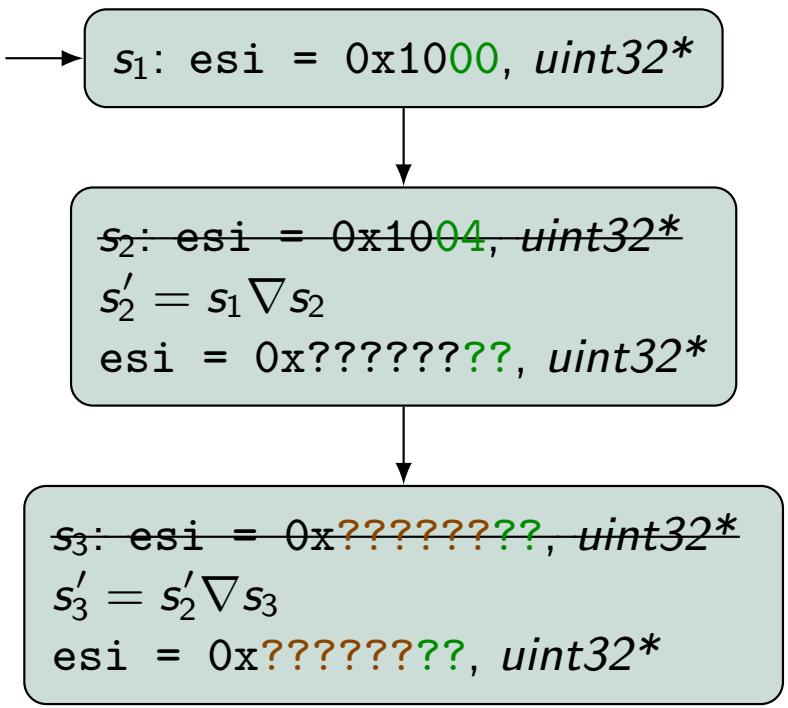

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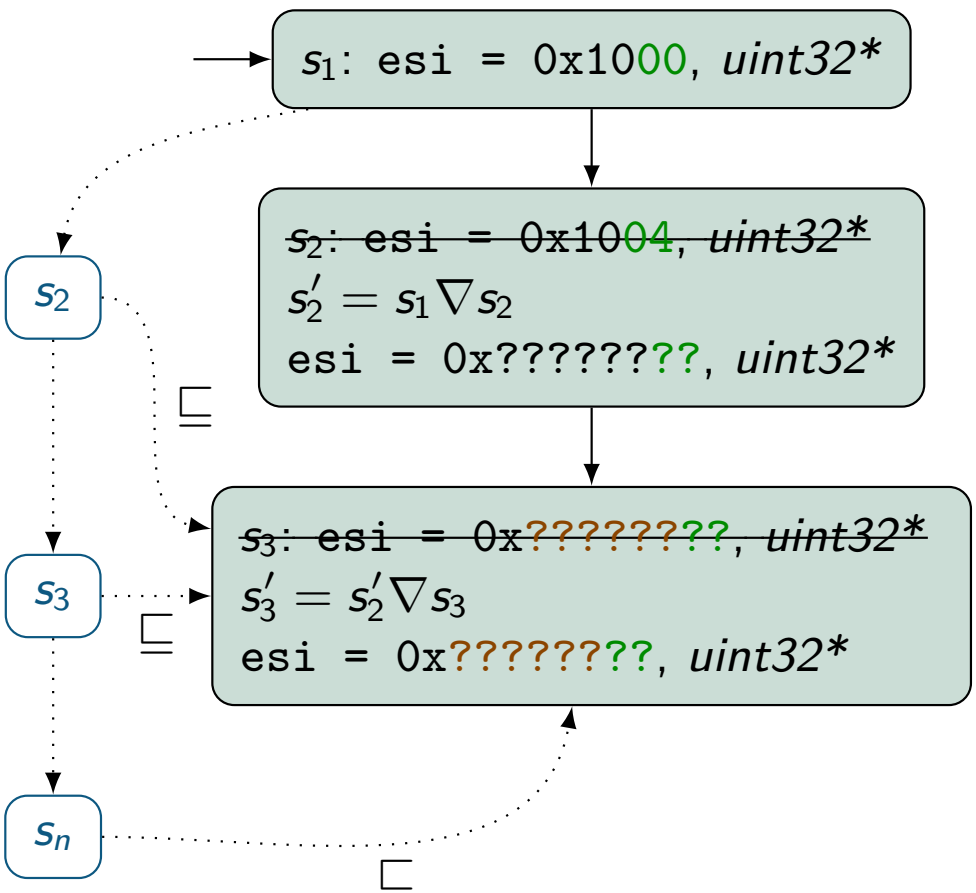

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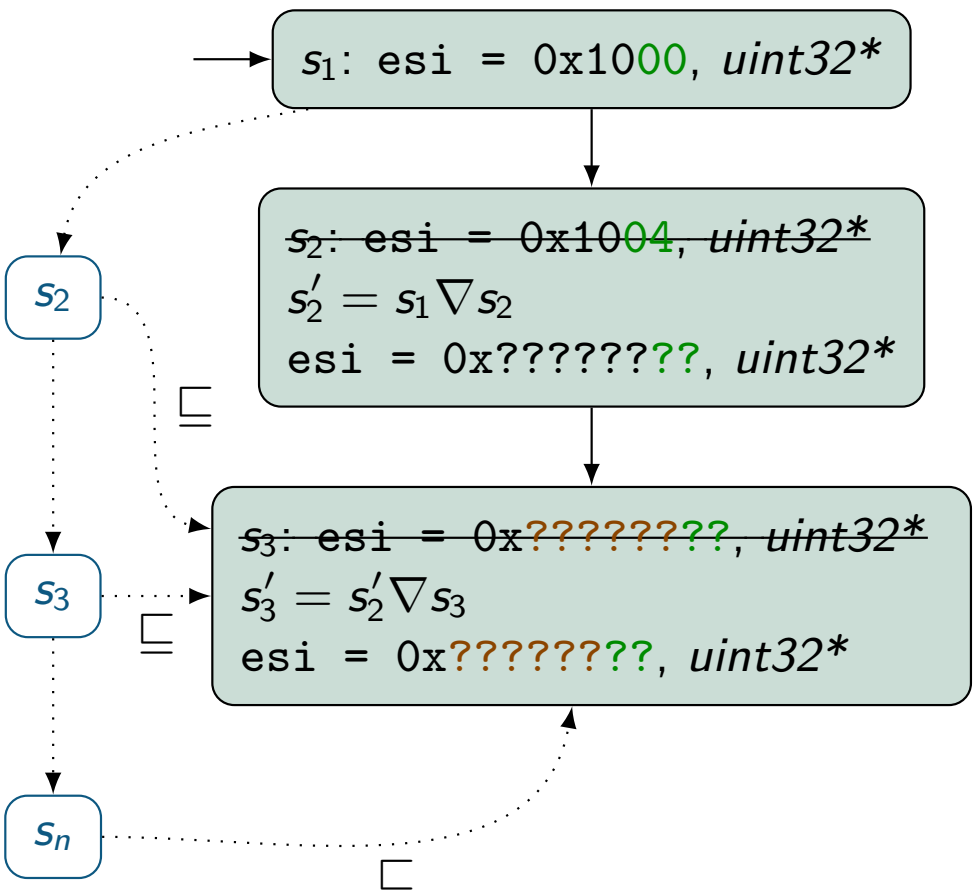

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- some techniques allow for precision recovery

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Analyzer's performance

Example: keygenme

- 6407 instructions analyzed
- RAM usage: 90 MiB
- running time: 6s
- average: $\simeq$ 1060 insn/s

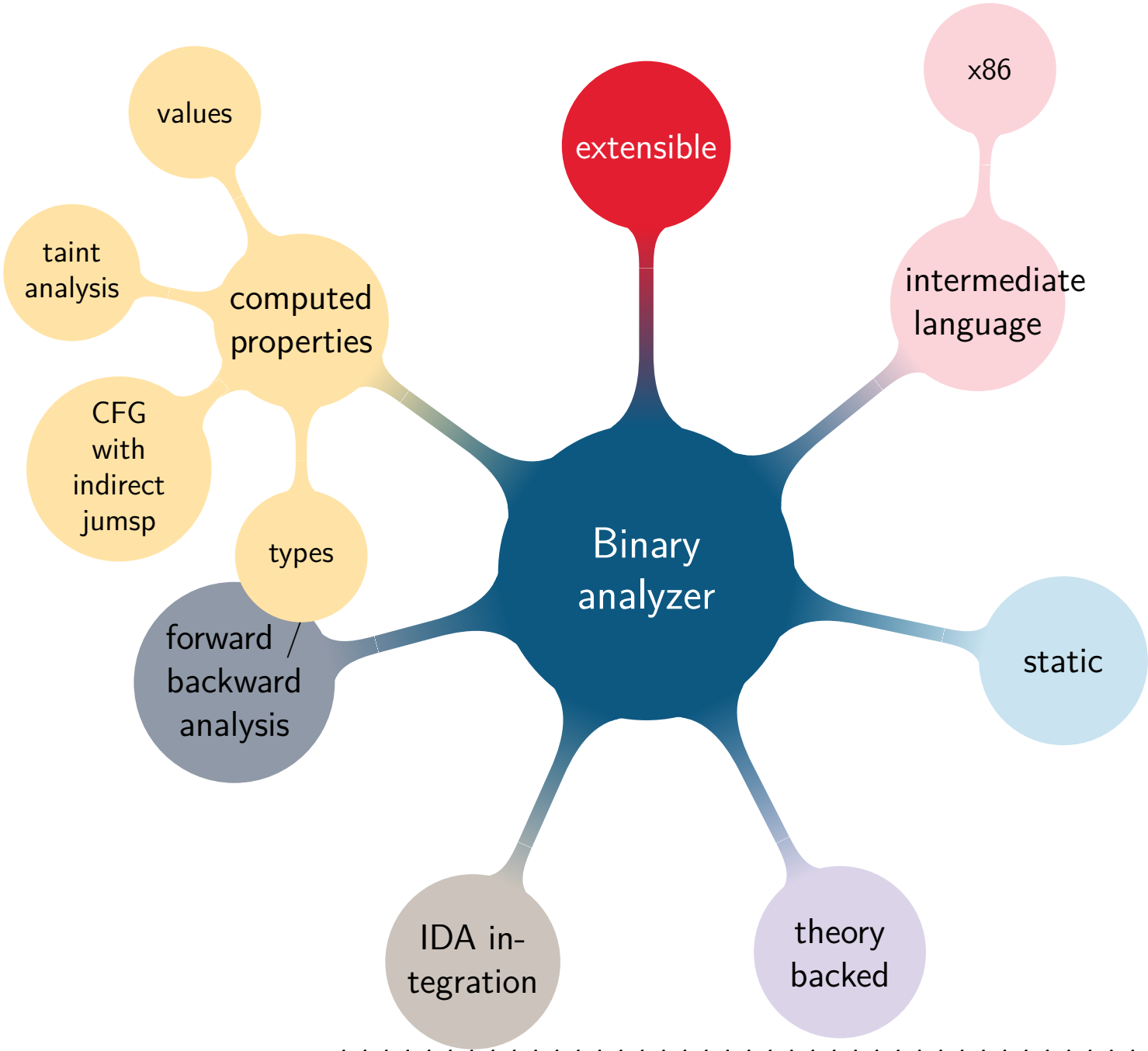
QEMU tests:

- 209 120 instructions analyzed
- RAM usage: 2.3 GiB
- running time: 23 min 30 s
- average: $\simeq$ 150 insn/s

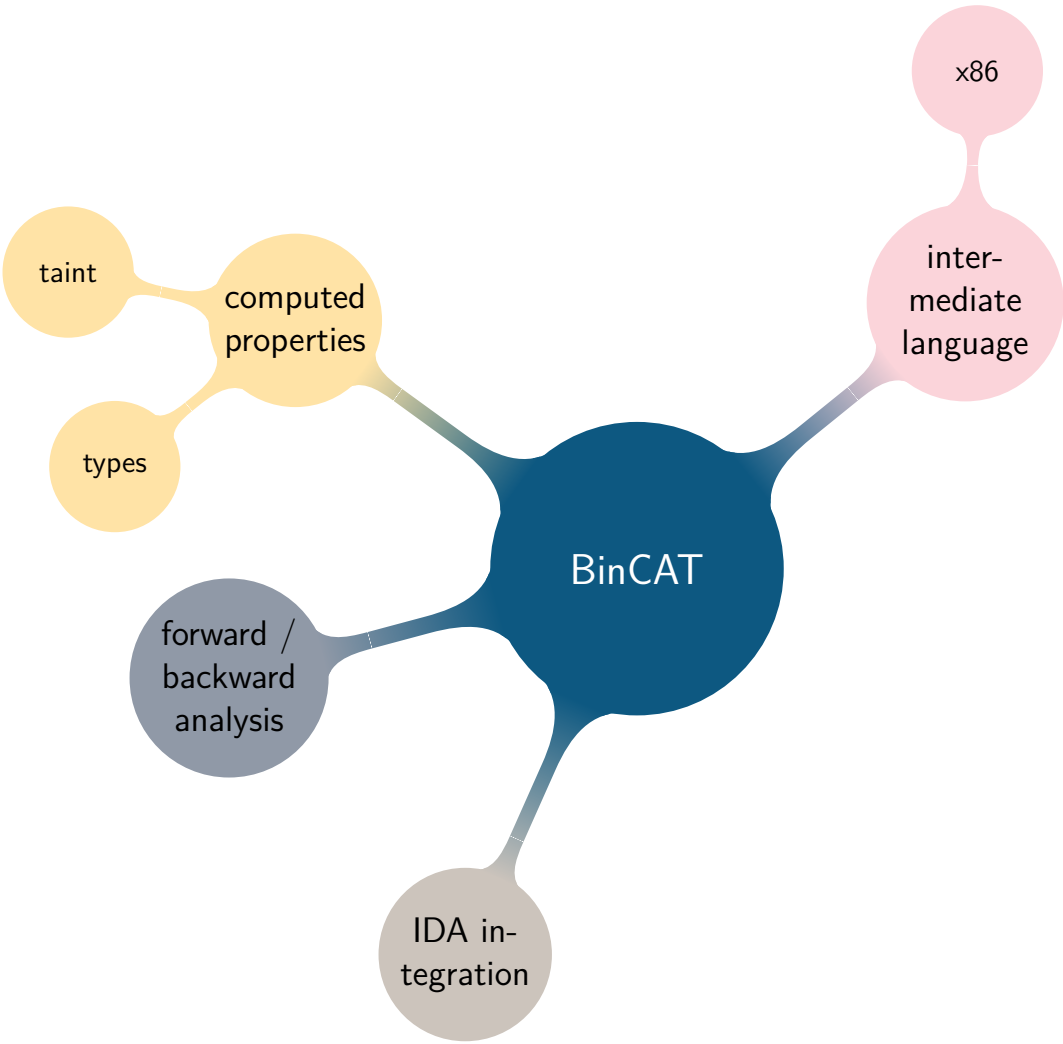
Intel Core i7-6700K CPU @ 4,00GHz

Plan

Conclusion

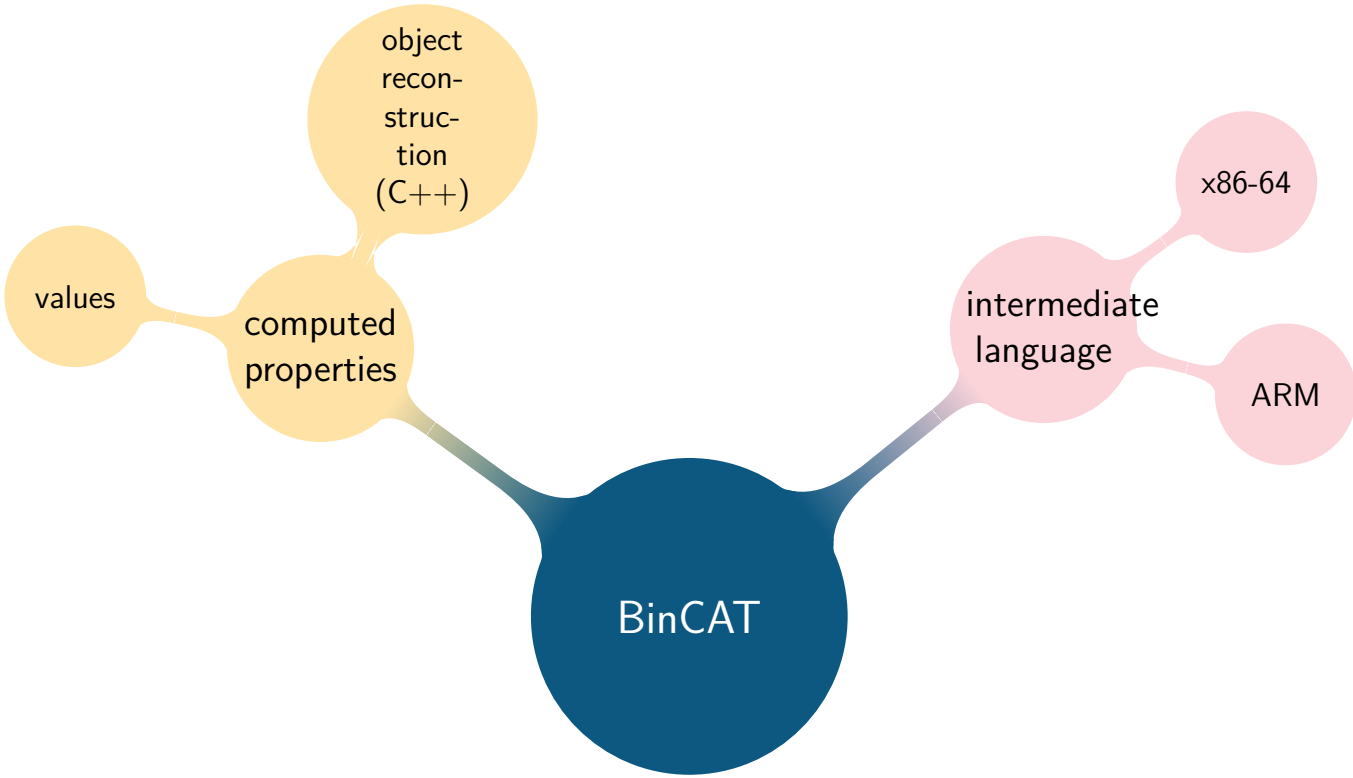

values
taint analysis
computed properties
CFG with indirect jumsp
types
forward / backward analysis
extensible
x86
intermediate language
Binary analyzer
static
IDA integration
theory backed

Current features improvements (planned)



- better type reconstruction
  - new types from heuristics. Ex: structures detection on stack
- several distinct taint sources
- more precise computations in backward analysis
- more standard library functions models
- type and value override in IDA
- memory definition directly in IDA

Future features



- finer approximations in values computation by using intervals
- complex objects reconstruction (C++)
- x86-64 and ARM decoders

Thanks!

Full paper (link in README):

`https://www.sstic.org/media/SSTIC2017/SSTIC-actes/bincat_purrfecting_binary_static_analysis/SSTIC2017-Article-bincat_purrfecting_binary_static_analysis-biondi_rigo_zennou_mehrenberger.pdf`

- project was partially financed by DGA-MI

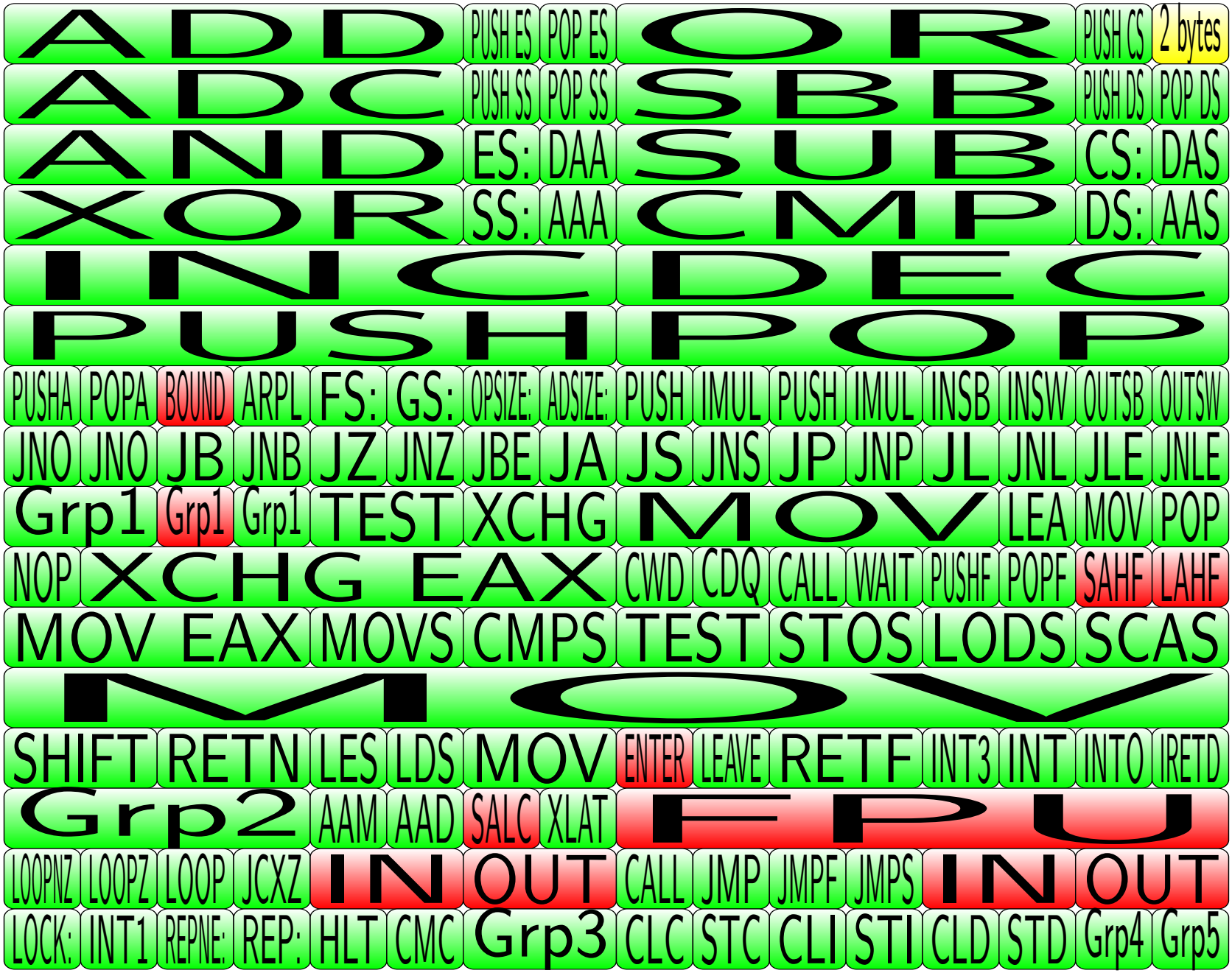
- Get it! (AGPL licence)

`https://github.com/airbus-seclab/bincat`

```
docker run -p 5000:5000 airbusseclab/bincat
```

tutorial in `doc/tutorial.md`

x86 coverage



x86 coverage - Second table

Currently implemented lattices