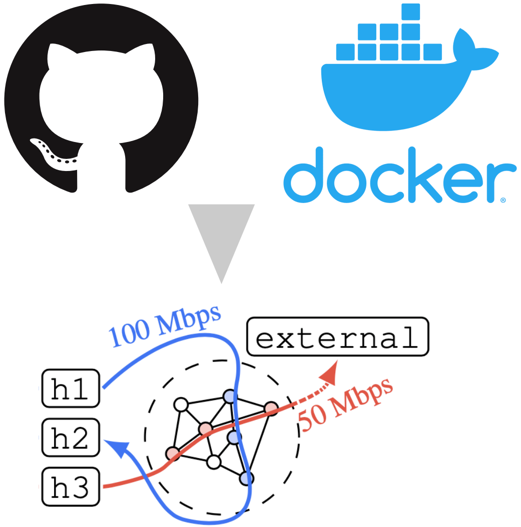
# Generating representative, live network traffic out of millions of code repositories



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ACM HotNets

Nov 14 2022

# Today, we only have a few gold nuggets of network data available

CAIDA

Intrusion Detection Evaluation Dataset (CIC-IDS2017)

RIPE Atlas

MAWI

Picture: https://www.scienceimage.csiro.au/image/10458

# We believe there exists an entire gold mine/pile of network data

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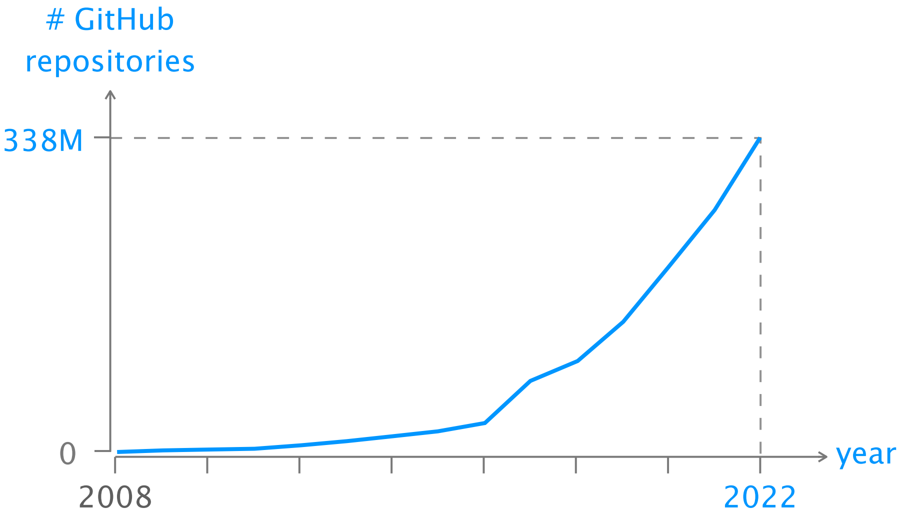

Picture: https://labs.openai.com/s/zD0NTe1h8FPJPCsjSlkZvKMv
Numbers: https://octoverse.github.com/
https://en.wikipedia.org/wiki/Timeline_of_GitHub

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# However, executing arbitrary open-source projects is challenging

| | |
|---|---|
| Arbitrary code | How do we build the projects?<br>Arbitrary code, language and APIs |
| Missing documentation | How do we run the projects?<br>Missing commands, dependencies and support |
| Unexpected errors | How do we handle bugs and errors?<br>Unexpected crashes, inputs and runtime |

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Orchestration files

Define how multiple containers are configured

A single command builds and starts all of them

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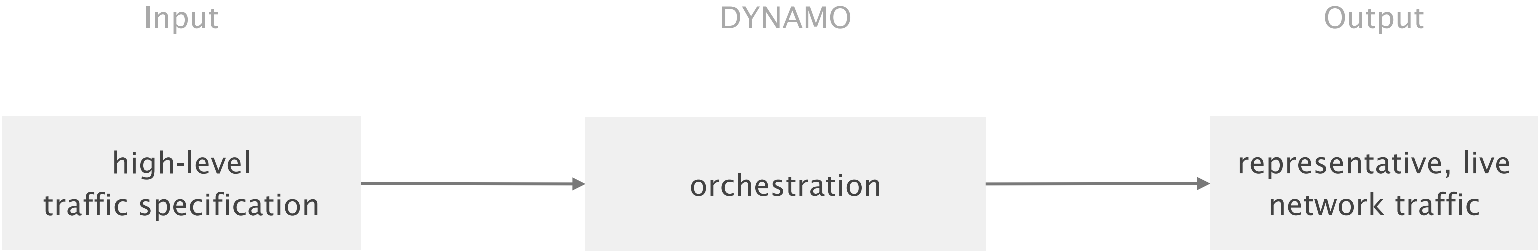
traffic/applications that
react to network events



Input

DYNAMO

Output

high-level
traffic specification

orchestration

representative, live
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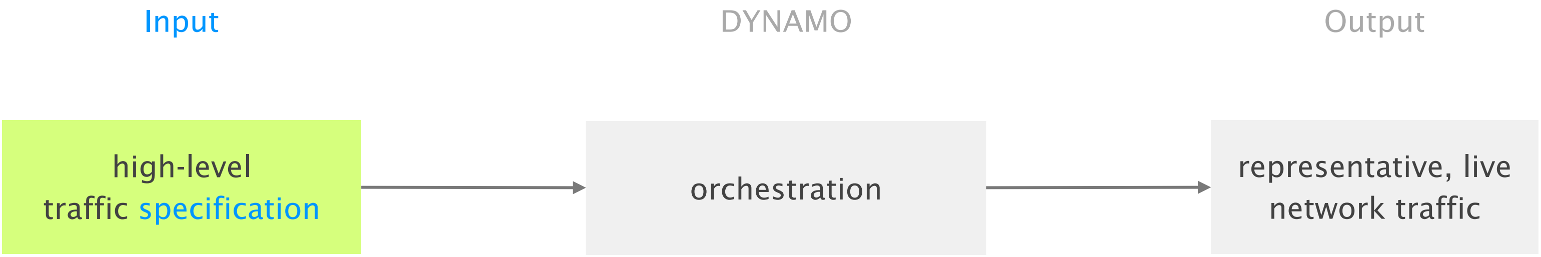

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generate database traffic
  from h3 to external
  with 50 Mbps
  using ⩾ 5 flows ;
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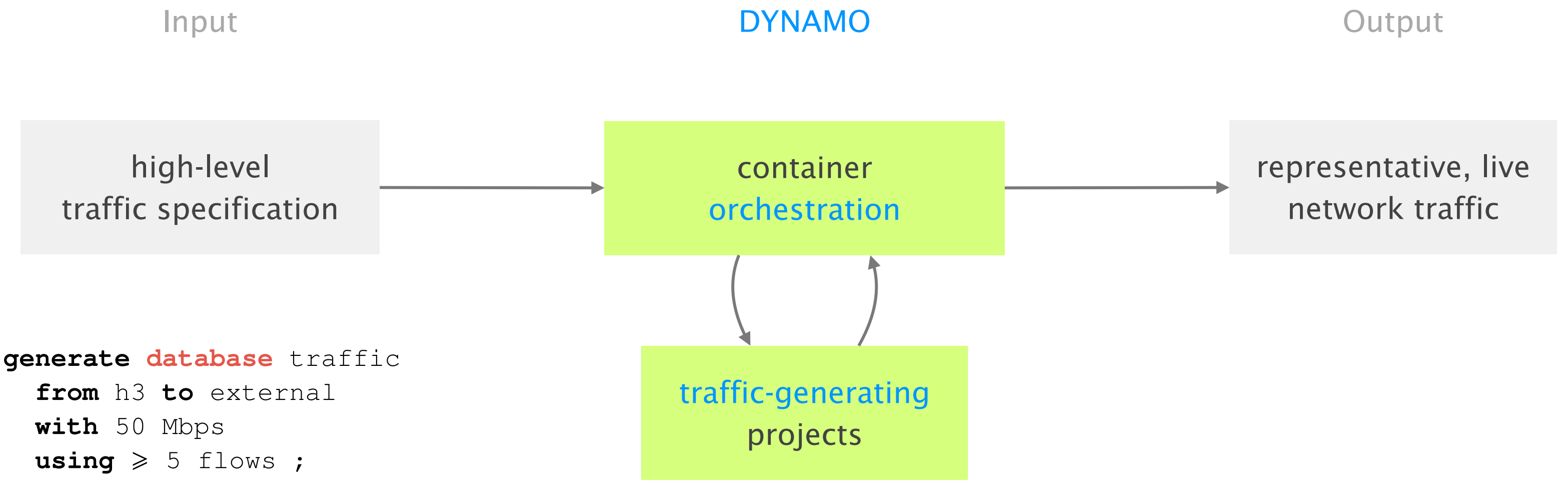

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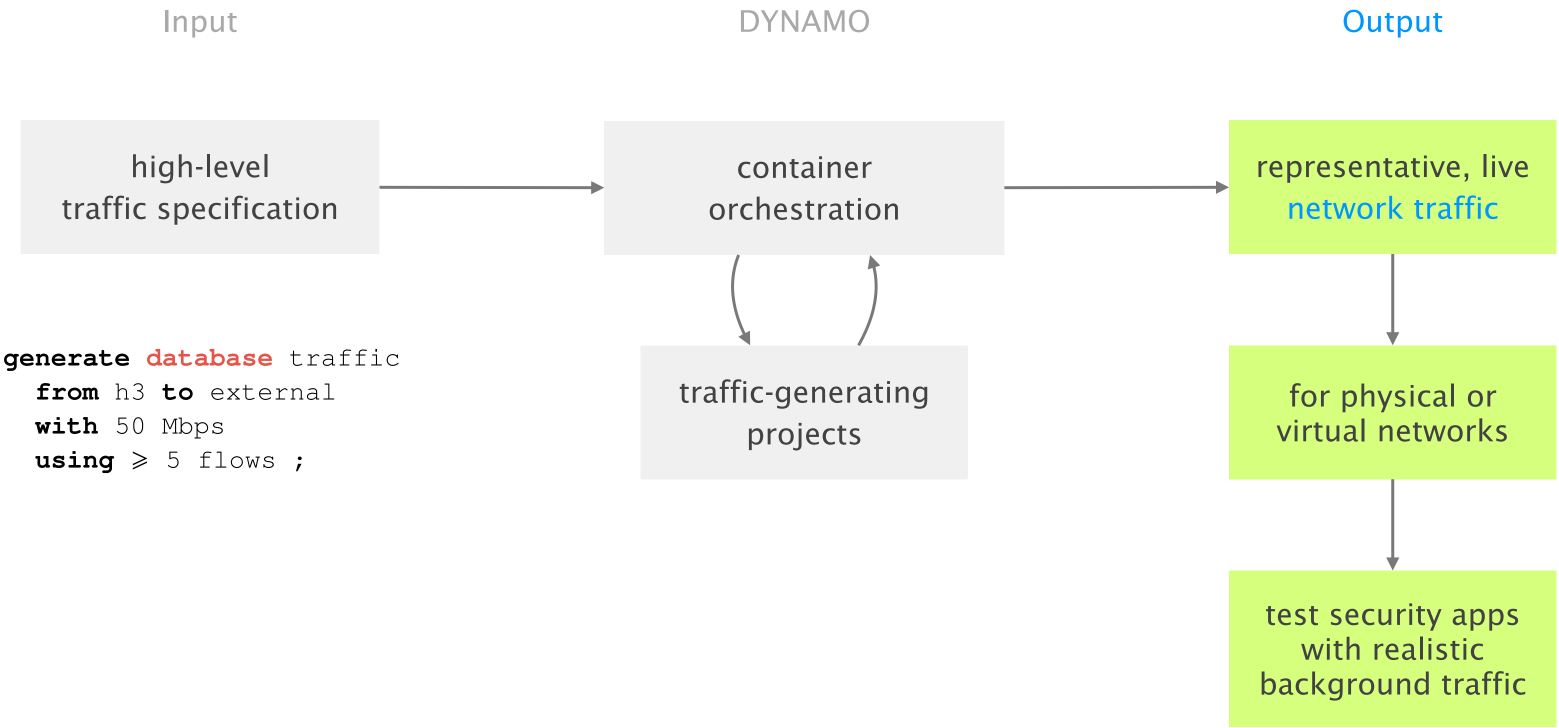

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representative, live network traffic

for physical or virtual networks

test security apps with realistic background traffic

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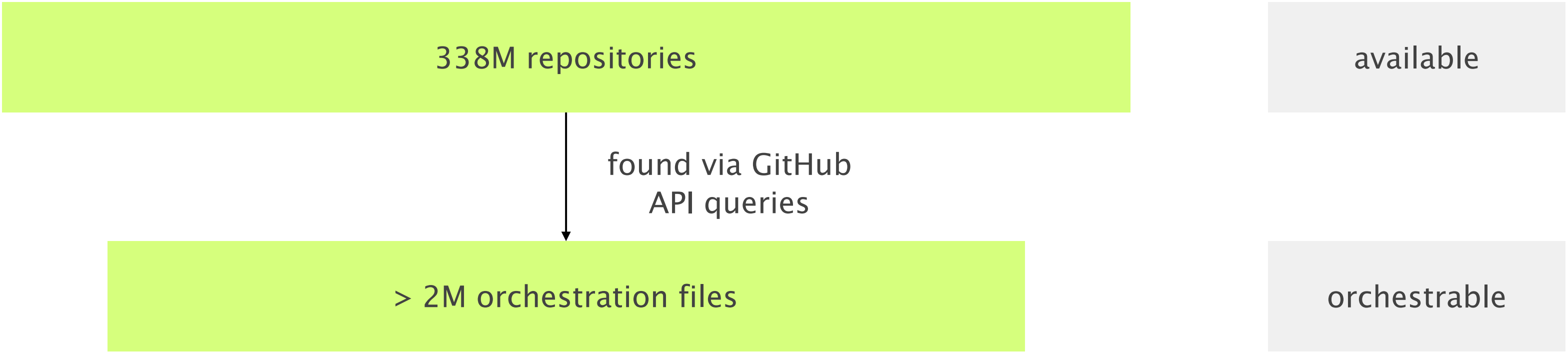

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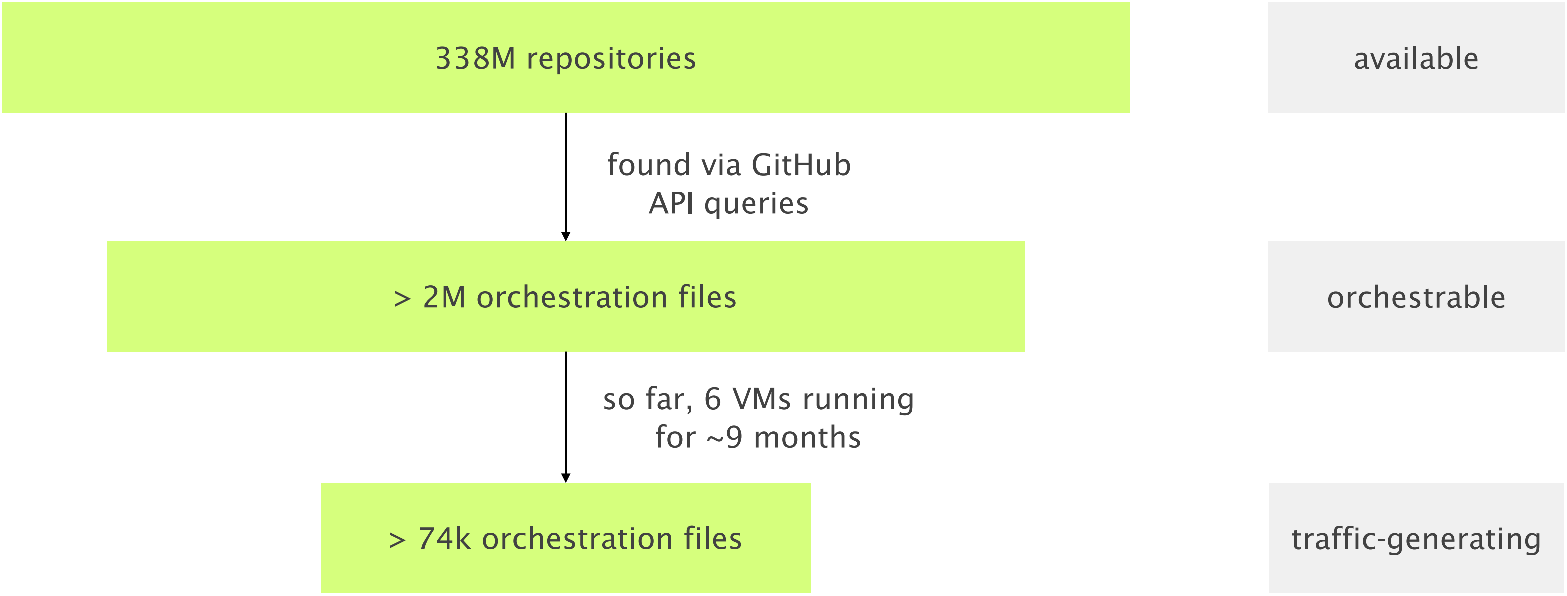

338M repositories

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> 2M orchestration files

so far, 6 VMs running for ~9 months

> 74k orchestration files

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orchestrable

traffic-generating

# Users then specify traffic requirements in a Declarative Traffic Specification Language

What kind of traffic?

Between which hosts?

How much traffic?

Example specification

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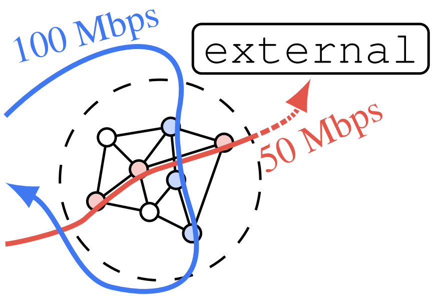

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a given user network

# To achieve that,

# DYNAMO needs to orchestrate matching containers

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## Identified projects

2× Project #5:
100 Mbps **web** traffic

Projects #7 and #18:
50 Mbps **database**
traffic using 7 flows

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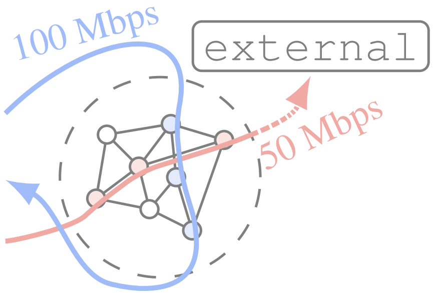

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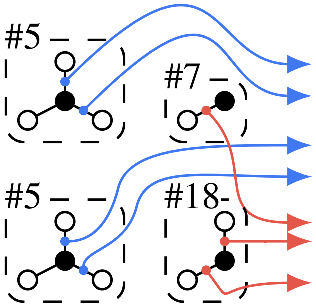
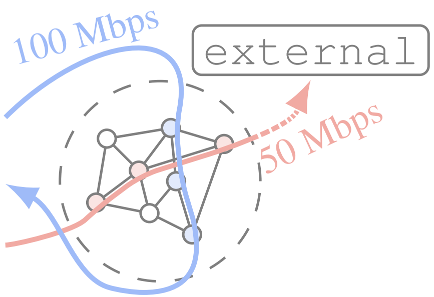


Run the correct containers

Traffic generation



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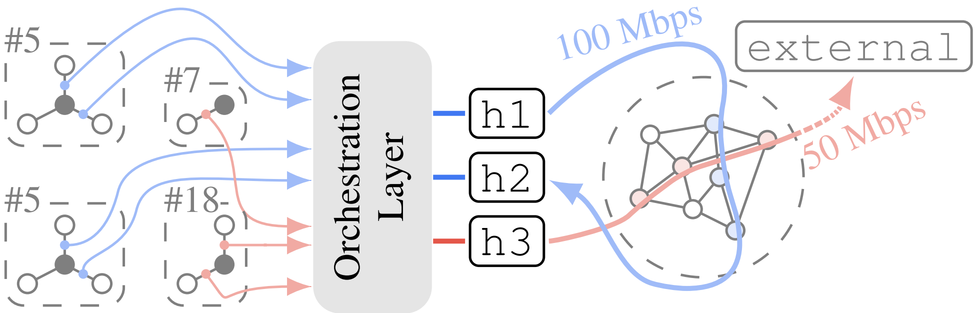
Setup | Orchestration | Traffic generation



Run the correct containers

Combine to virtual hosts

Send live traffic through a given user network

# DYNAMO enables many use cases

## And we'd love to hear more from you!

Security testing

DYNAMO generates real background traffic

E.g., to combine with attack traffic

Network design

DYNAMO tests applications under different designs

E.g., impact of packet loss on Bitcoin traffic

Trace generation

DYNAMO creates data sets with specific properties

E.g., to complement skewed ML training data

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web (HTTP, HTTPS)

crypto (Bitcoin, IPFS)

database (MongoDB, MySQL)

message-broker (RabbitMQ, Apache Kafka)

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Some of the applications generate *a lot of* traffic

> 13M pkts (~417 Mbps), a multi-paxos implementation: `thibmeu/imperial-multi-paxos-in-elixir`

> 367k flows (~4 Mbps), a Telegram proxy: `squizduos/docker-server`

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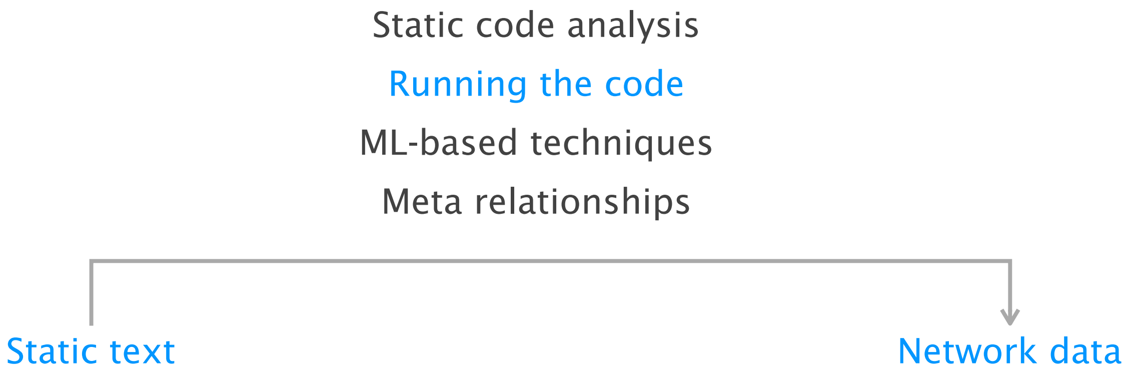

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ML-based techniques

Meta relationships

Static text

Network data

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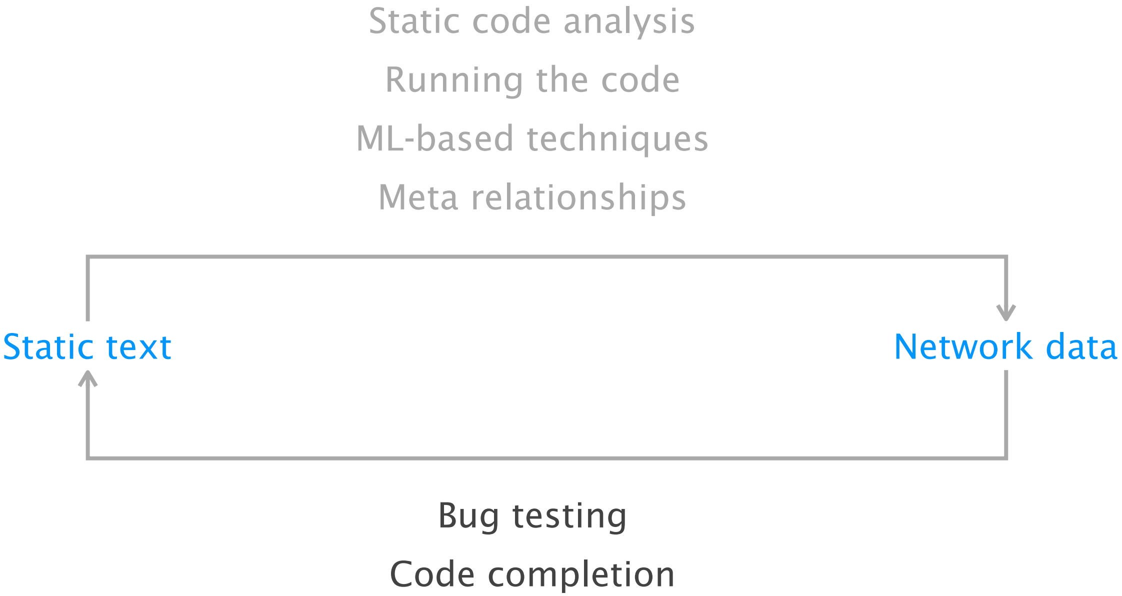

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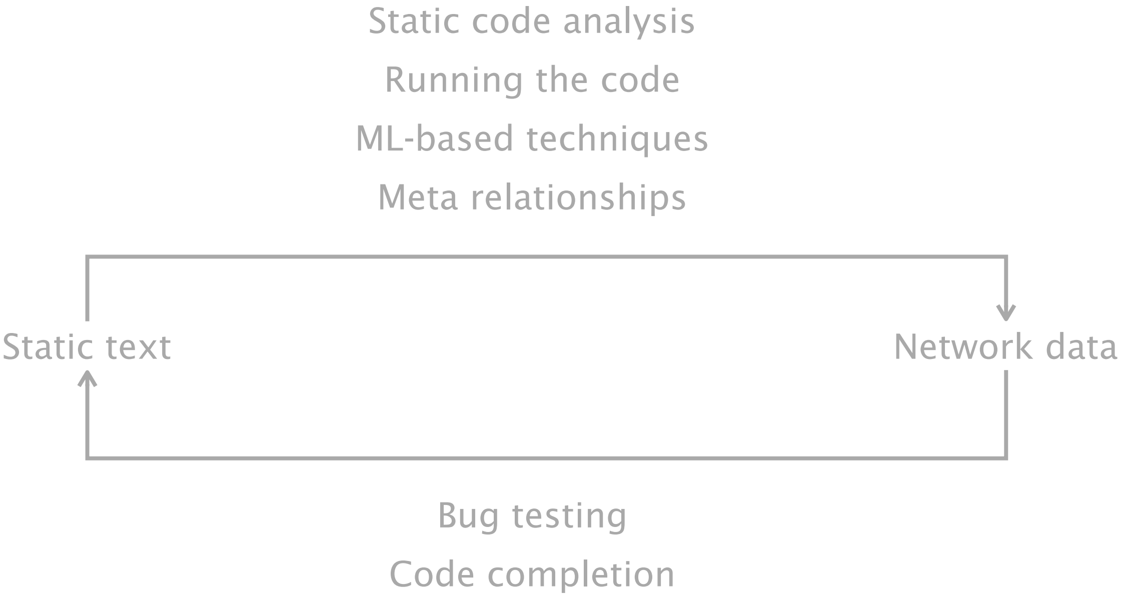

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