EXPLORING API/CLIENT

CO-EVOLUTION

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CO-EVOLUTION OF SOFTWARE LANGUAGES AND LANGUAGE PROCESSORS

CO-EVOLUTION

SOFTWARE LANGUAGE

STANDARD
COMPILER
...

LANGUAGE PROCESSOR

PARSER
REFACTORIZING TOOL
...

Evolves
induces changes
conform to
Evolves
API/CLIENT CO-EVOLUTION

**CO-EVOLUTION**

- API Evolves induces changes depends on CLIENT
- Evolves SOFTWARE
- LANGUAGE LIBRARY ...

Diagram showing the co-evolution between API and CLIENT, with other components such as LANGUAGE, LIBRARY, and SOFTWARE involved.
API/CLIENT CO-EVOLUTION

**CO-EVOLUTION**

- Evolves: API
  - induces changes
  - depends on: LIBRARY
- Evolves: CLIENT
  - depends on: SOFTWARE IN JAVA
API/CLIENT CO-EVOLUTION - WHO CARES?

- API DEVELOPER uses API
- CLIENT DEVELOPER
- RESEARCHER solves problems
- USER uses product
API/CLIENT CO-EVOLUTION - WHAT DO THEY CARE ABOUT?

API DEVELOPER

uses API

CLIENT DEVELOPER

solves problems

RESEARCHER

uses product

USER

HOW DOES CLIENTS USE MY API?
WHAT ARE THE HOTSPOTS AND COLD-SPOTS?
SHOULD I REORGANISE OR SPLIT IT?
HOW CAN I HELP MY CLIENTS MIGRATE?
API/CLIENT CO-EVOLUTION - WHAT DO THEY CARE ABOUT?

- **API DEVELOPER** uses API
- **CLIENT DEVELOPER** solves problems
- **USER** uses product
- **RESEARCHER**

Questions:
- How well is my code utilising this API?
- How do I migrate to a new version?
- Do I really need to migrate?
- How do I migrate to another library?
API/CLIENT CO-EVOLUTION - WHAT DO THEY CARE ABOUT?

API DEVELOPER

uses API

CLIENT DEVELOPER

solves problems

RESEARCHER

uses product

USER

which product should I use?
how safe is it?
how well maintained will it be?
API/CLIENT CO-EVOLUTION - WHAT DO THEY CARE ABOUT?

- **API DEVELOPER**
  - uses API

- **CLIENT DEVELOPER**
  - solves problems

- **USER**
  - uses product

- **RESEARCHER**

**HOW DO I USE MY COMPETENCE TO SOLVE THESE PROBLEMS?**
Are the number of clients of this API increasing or decreasing?
Do clients of this API usually immediately update their code upon an API release?
What are hotspots in my API?
Which methods are usually used together? In what order?
How do we collect data?

API

Evolves

Induces changes

CLIENT

Evolves

Depends on

LIBRARY

SOFTWARE
HOW DO WE COLLECT DATA?

- **API**
  - Evolves
  - Induces changes

- **CLIENT**
  - Evolves

- **LIBRARY**
  - Evolves
  - Depends on

- **SOFTWARE**

[DIG, 2006]
HOW DO WE COLLECT DATA?

[LAEMEL, 2011] [SAWANT, 2015]

API

Depends on

CLIENT

SOFTWARE

LIBRARY

Evolves

Induces changes

Evolves
**PREVIOUS WORK**

5 handpicked APIs
2 major releases
breaking changes
manual analysis

1476 SourceForge projects
69 APIs
per commit
automated analysis

20'263 GitHub projects
5 popular APIs
per commit
automated analysis

SQL queries

“80% REFACTORINGS”

“API FOOTPRINT”

“DO CLIENTS MIGRATE?”

“API USE COVERAGE”

[DIJ, 2006]

[LÄMMEL, 2011]

[SAWANT, 2015]

[SAWANT, 2017]
PATH OF LEAST RESISTANCE

API

CLIENT

API DEVELOPER

CLIENT DEVELOPER

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HAPPY PATH!

API DEVELOPER

CLIENT DEVELOPER

API/CLIENT DATASET

RESEARCHERS

API

CLIENT

collect

share

use

contribute

generate data

answer questions

answer questions

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PROBLEMS

- Complex interactions cannot be used automatically
- Results of previous research are difficult to reuse

OUR SOLUTION

- Make extendable dataset:
  ‘simple building blocks, complex patterns’
- Use knowledge base (Jena / Graal)
- Abstract (and extend) by inference rules
- Extendable by other researchers: new rules, new results