Measuring the degree of library dependency

Núria Bruch Tàrrega

January 2020

Academic Supervisor: dr. Ana Oprescu
Host Supervisor: Lodewijk Bergmans
Host Organization: Software Improvement Group (SIG)

UNIVERSITEIT VAN AMSTERDAM

Outline

1. Introduction
2. Research Question 1
3. Research Question 2
4. Expected results

Introduction

Dependency Management

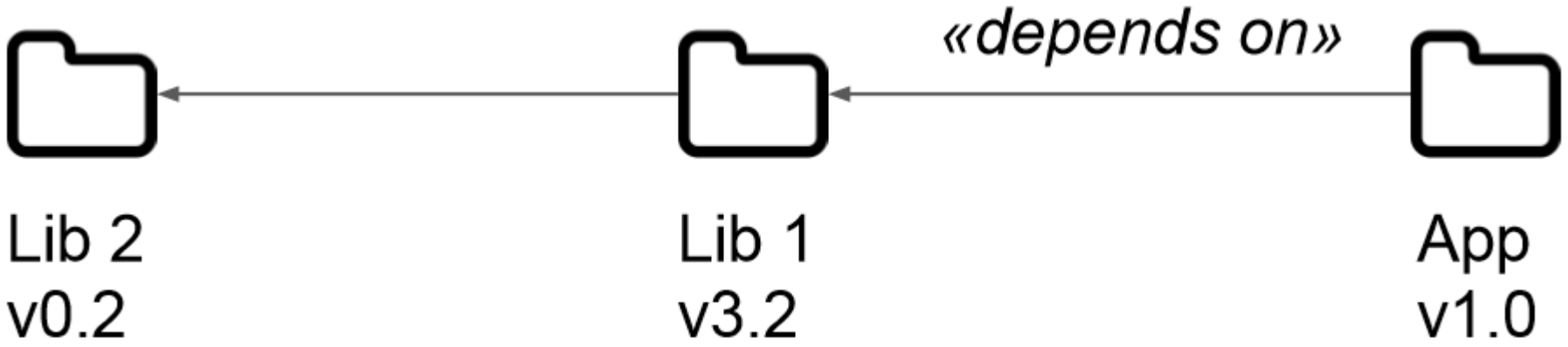
- Library vulnerabilities
- Library versions adoption

Dependency Management

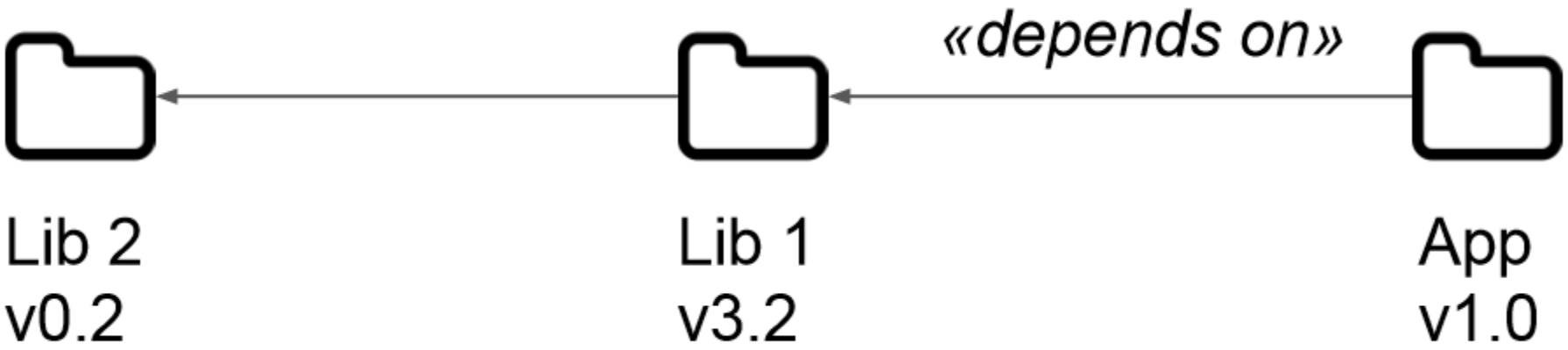
- How to model Software ecosystems?

Dependency Management

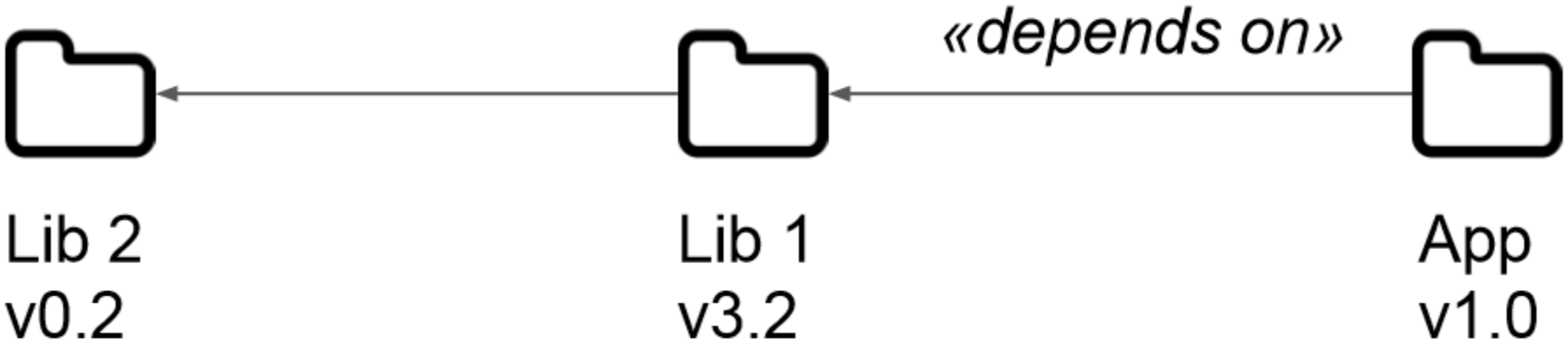
- How to model Software ecosystems?



Research Question 1


«depends on»
Lib 2
v0.2
Lib 1
v3.2
App
v1.0

How can we measure the degree of library dependency?

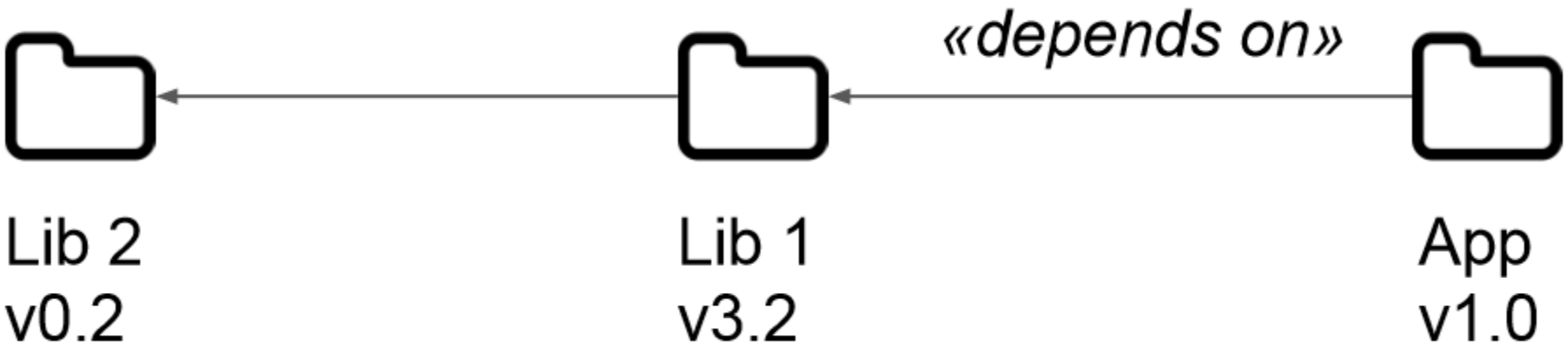


How can we measure the degree of library dependency?

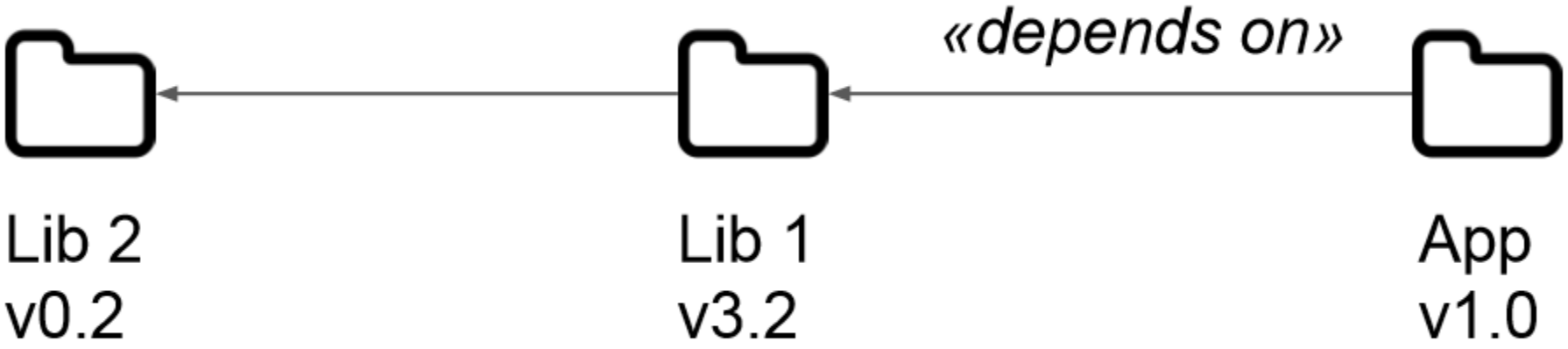
Which metrics are used to measure dependency in a project?

Coupling metrics

Research Question 2


«depends on»
Lib 2
v0.2
Lib 1
v3.2
App
v1.0

How can we measure the effort needed to replace a library?



How can we measure the effort needed to replace a library?

How do we measure effort?

COCOMO II

How can we measure the effort needed to replace a library?

How do we measure effort?

COCOMO II

COCHCOMO → Effort to change code

Expected results

1. Set of metrics

- Coupling between a project and the libraries it uses
- Model to estimate the effort needed to replace a library

1. Set of metrics

- Coupling between a project and the libraries it uses
- Model to estimate the effort needed to replace a library

✓ Formal definition

✓ Validation criteria

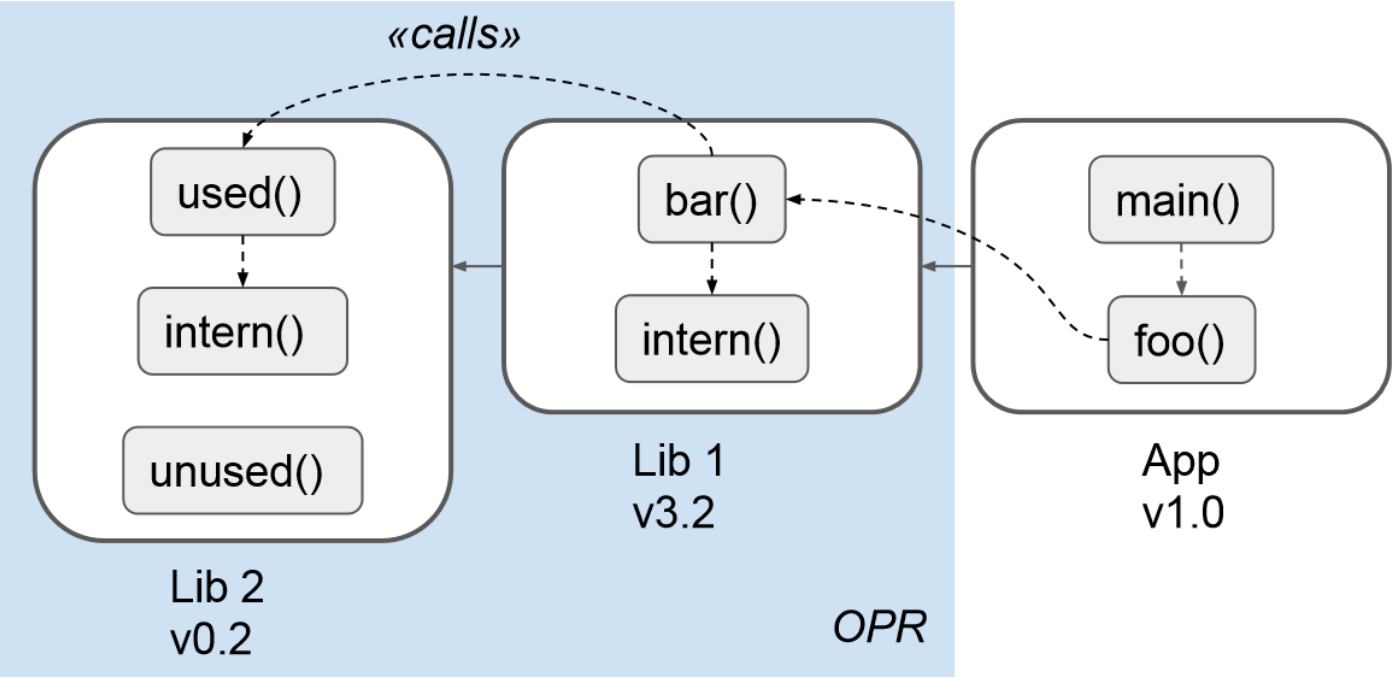
2. Proof-of-Concept

- Prototype to calculate the metrics

2. Proof-of-Concept

- Prototype to calculate the metrics

- Call-level dependency graph



J. Hejderup, M. Beller,
G. Gousios (2018)

J. Hejderup, A. van Deursen,
G. Gousios (2018)

3. Evaluation and validation

Metrics
Validation

Theoretically
Empirically

- Mathematical Properties of Measures for Coupling
  Srinivasan et al. 2014
- Validation criteria for metrics
  Meneely et al. 2013

Measuring the degree of library dependency

Núria Bruch Tàrrega

January 2020

Academic Supervisor: dr. Ana Oprescu
Host Supervisor: Lodewijk Bergmans
Host Organization: Software Improvement Group (SIG)

UNIVERSITEIT VAN AMSTERDAM

Research Method

Technical Action Research

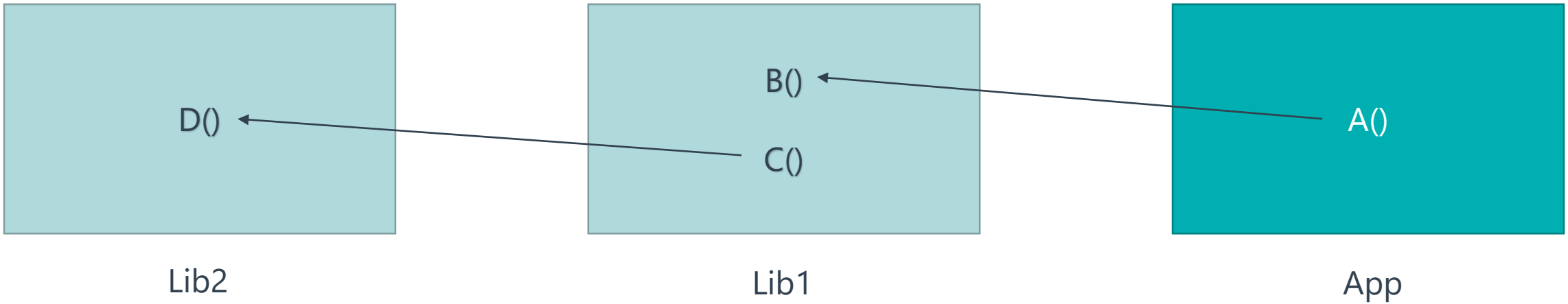
- Controlled experiments → Coupling metrics
- Case study → Effort measurement

Choosing applicable coupling metrics

- Does the metric depend on the two projects being developed by the same team?
- Does the metric consider inheritance?
- Does the metric consider indirect coupling?
- In which direction does the metric measure coupling?

Some applicable metrics

- **RFCα** → Response for class
  - Considers transitivity
  - Both inheritance and non-inheritance
- **ICP** → Information-flow-based coupling
  - Sum inheritance and non-inheritance


D()
B()
C()
A()
Lib2
Lib1
App