Testing and Quality Assurance in the Era of Continuous Development in the Cloud

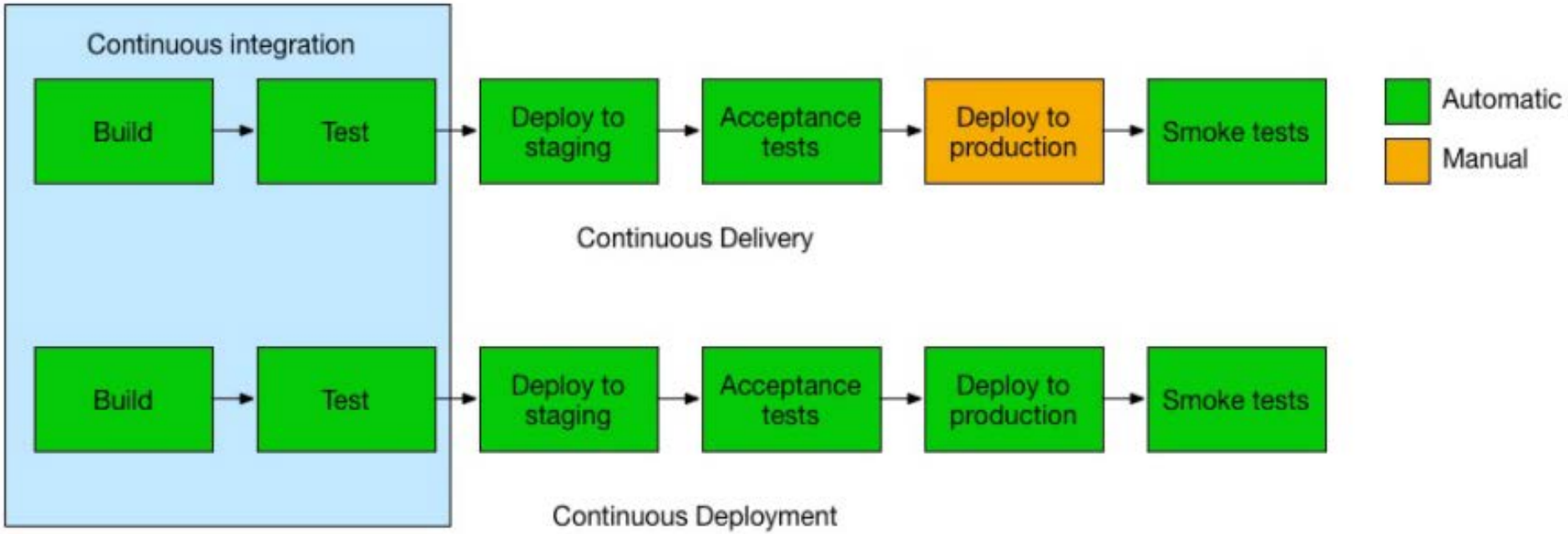
Michael Felderer

Department of Computer Science
University of Innsbruck, Austria

Department of Software Engineering
Blekinge Institute of Technology, Sweden

Bolzano, December 15, 2017

Continuous Integration, Delivery, and Deployment



Atlassian

Usage in Industry (2016)

Overall 69 survey participants

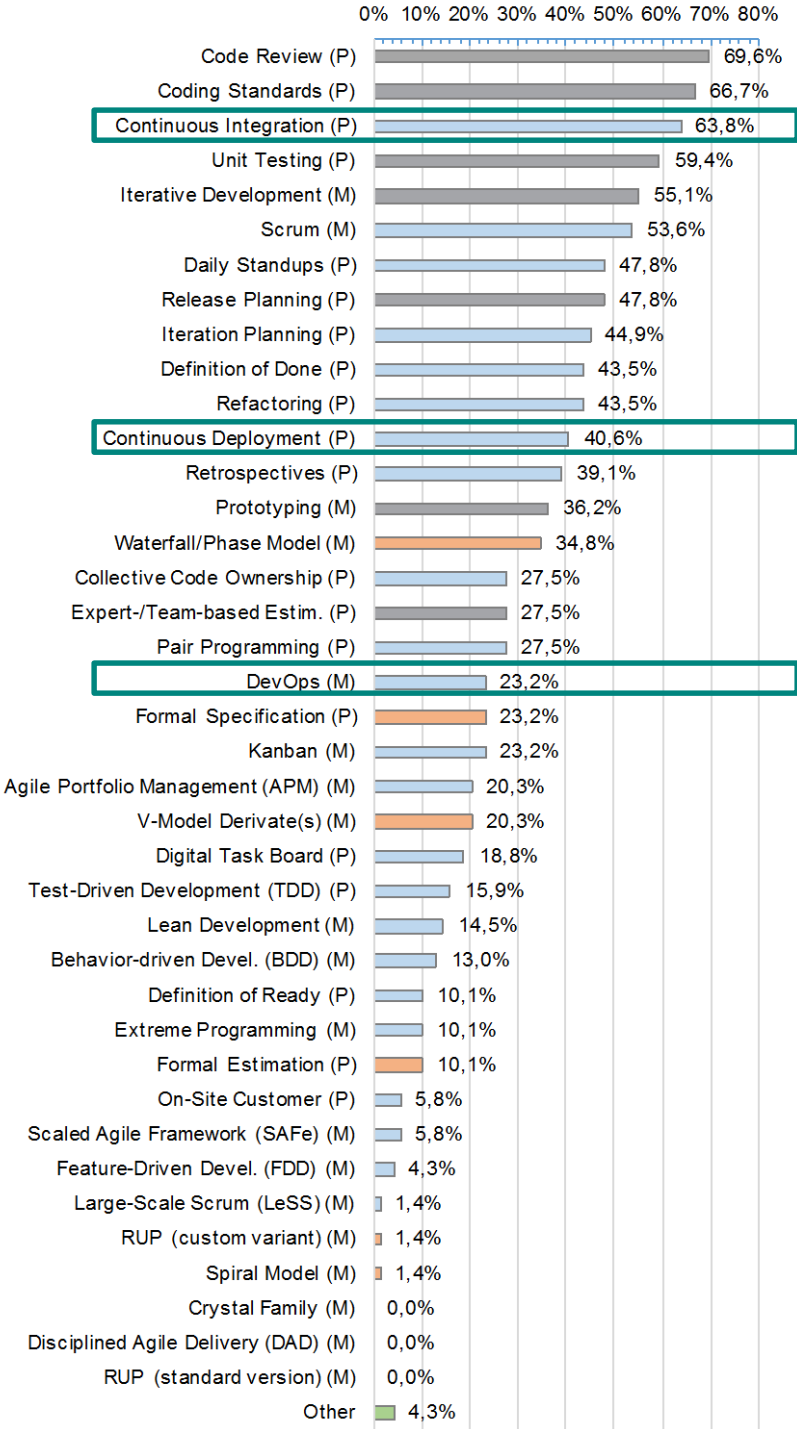
Continuous Integration (63.8%)

Continuous Delivery/Deployment (40.6%)

DevOps (23.2%)

	Micro	Small	Medium	Large	Very Large	Σ	%
Project/Team Manager	4	3	5	4	3	19	27.5
Architect	3	2	–	1	2	8	11.6
Tester	1	1	1	2	3	8	11.6
Product Manager/Owner	3	1	1	1	1	7	10.1
Quality Manager	1	–	2	2	2	7	10.1
Developer	–	5	–	1	–	6	8.7
Other	–	1	1	1	3	6	8.7
Analyst/Req. Engineer	–	1	–	1	1	3	4.3
Trainer/Coach	–	–	1	–	2	3	4.3
Scrum Master	–	–	1	1	–	2	2.9
Σ	12	14	12	14	17	**69**	
%	17.4	20.3	17.4	20.3	24.6		**100**

Kuhrmann et al.: Hybrid software and system development in practice: waterfall, scrum, and beyond. ICSSP 2017



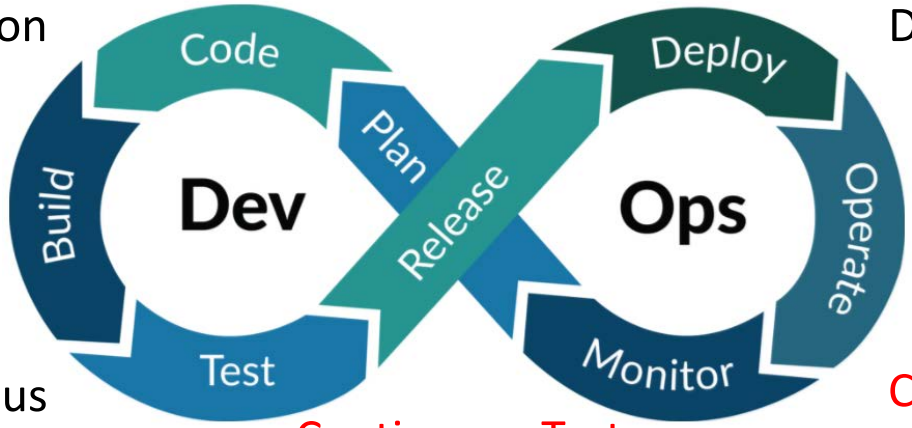
DevOps and C*

Increasing need to develop or deploy cloud-based applications

DevOps implies **automation and monitoring** at all steps of software construction

Continuous Integration

Continuous Deployment

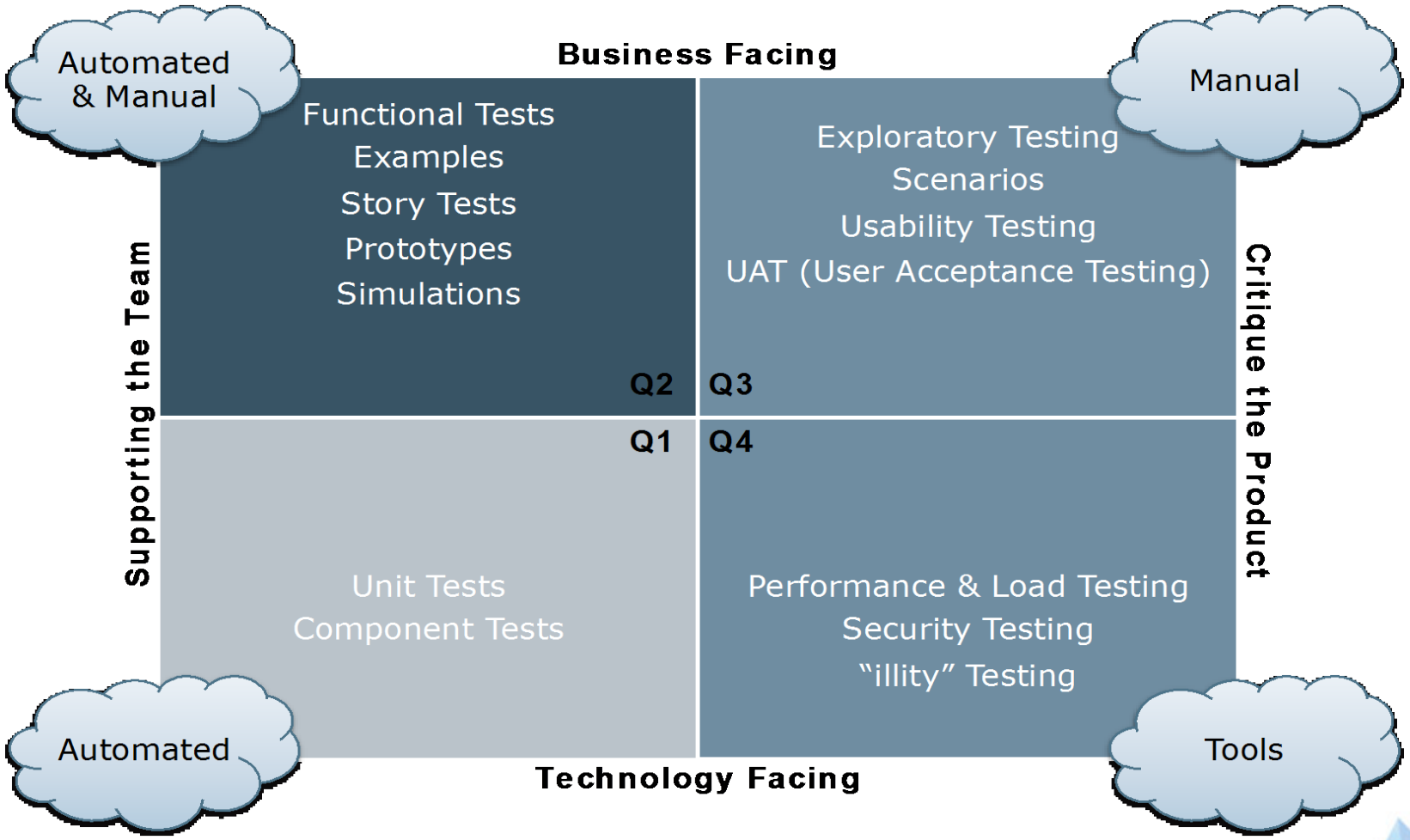


Continuous Delivery

Continuous Test

Continuous Experimentation

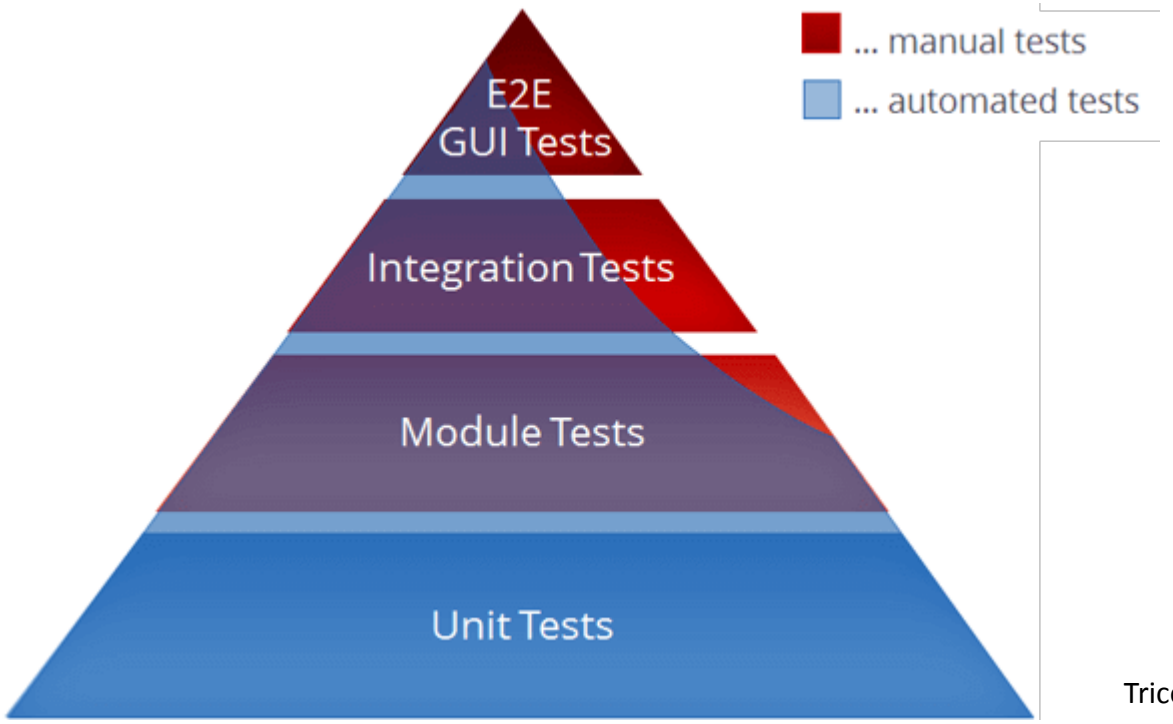
Agile Testing Quadrant



Continuous Testing

Executing **automated tests** as part of the software delivery pipeline to obtain **immediate feedback on the business risks** associated with a software release candidate

Fully integrate testing into development



Continuous Experimentation

Field/Live experiments with relevant stakeholders based on repeated Build – Measure – Learn cycles

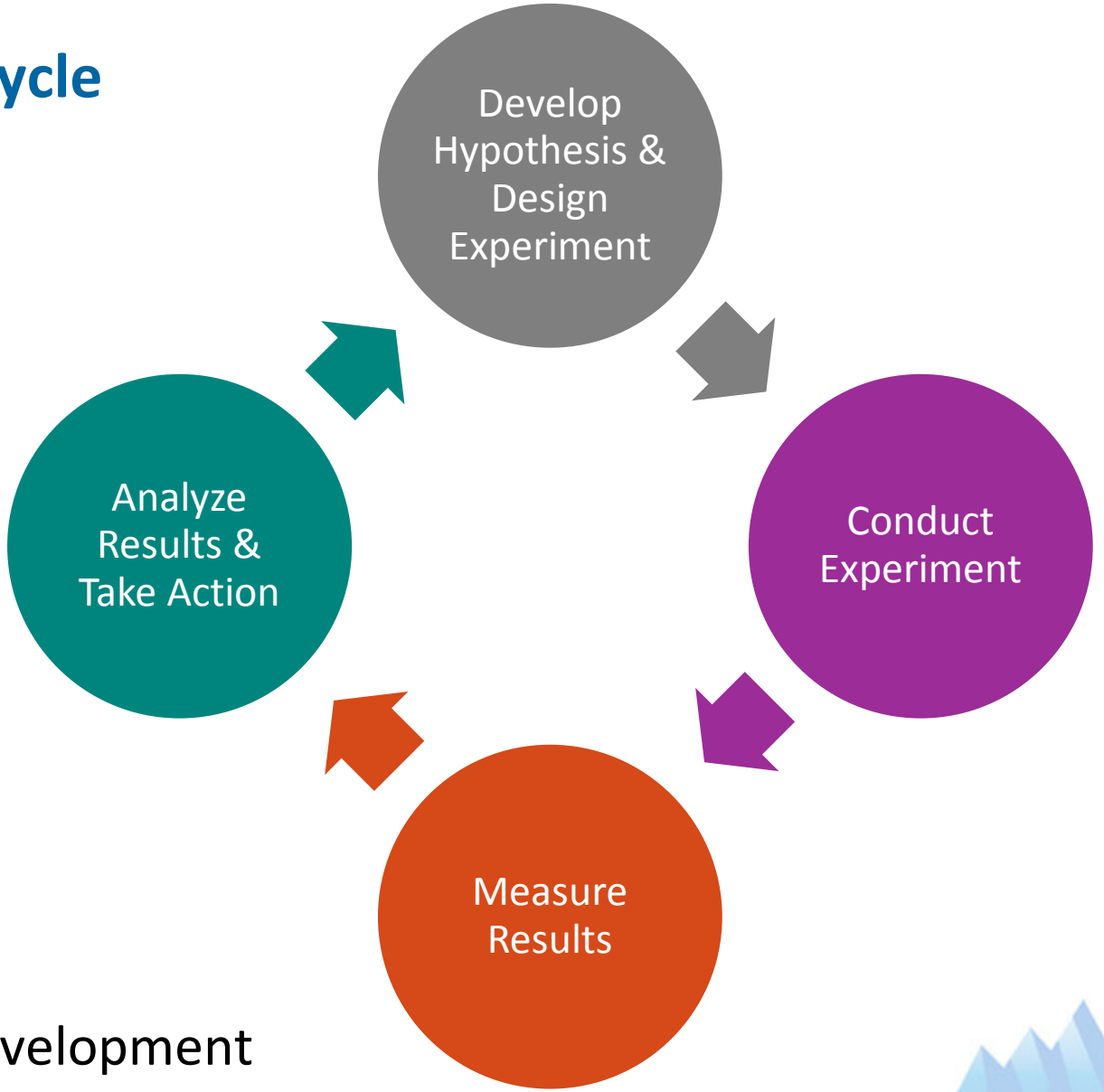
It‘s rare for a day to go by when we‘re not releasing at least one experiment

Twitter

At any given point in time, there isn‘t just one version of Facebook running, there are probably 10,000

Facebook

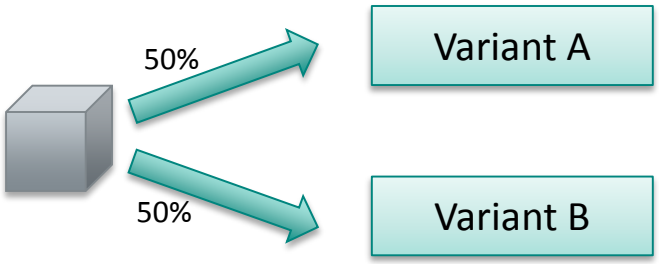
Experimentation Cycle



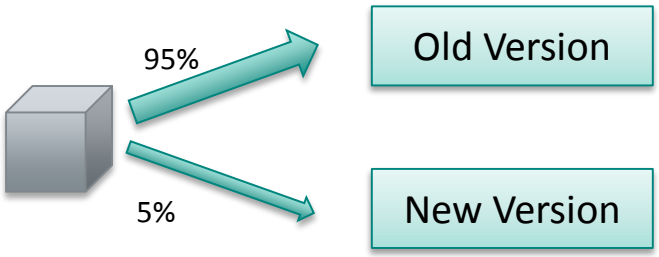
Hypothesis Driven Development

Not Just A/B Testing: Types of Experiments

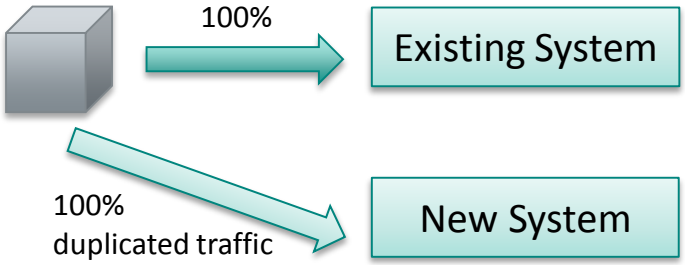
A/B Test



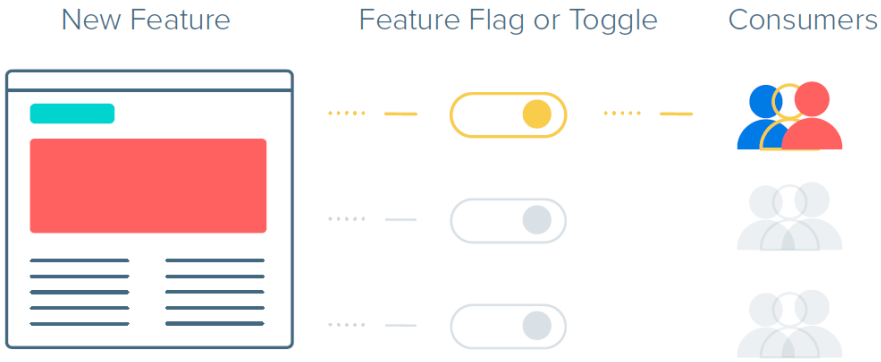
Canary Release



Dark Launch



Technological Basis for Experimentation



Feature Toggles

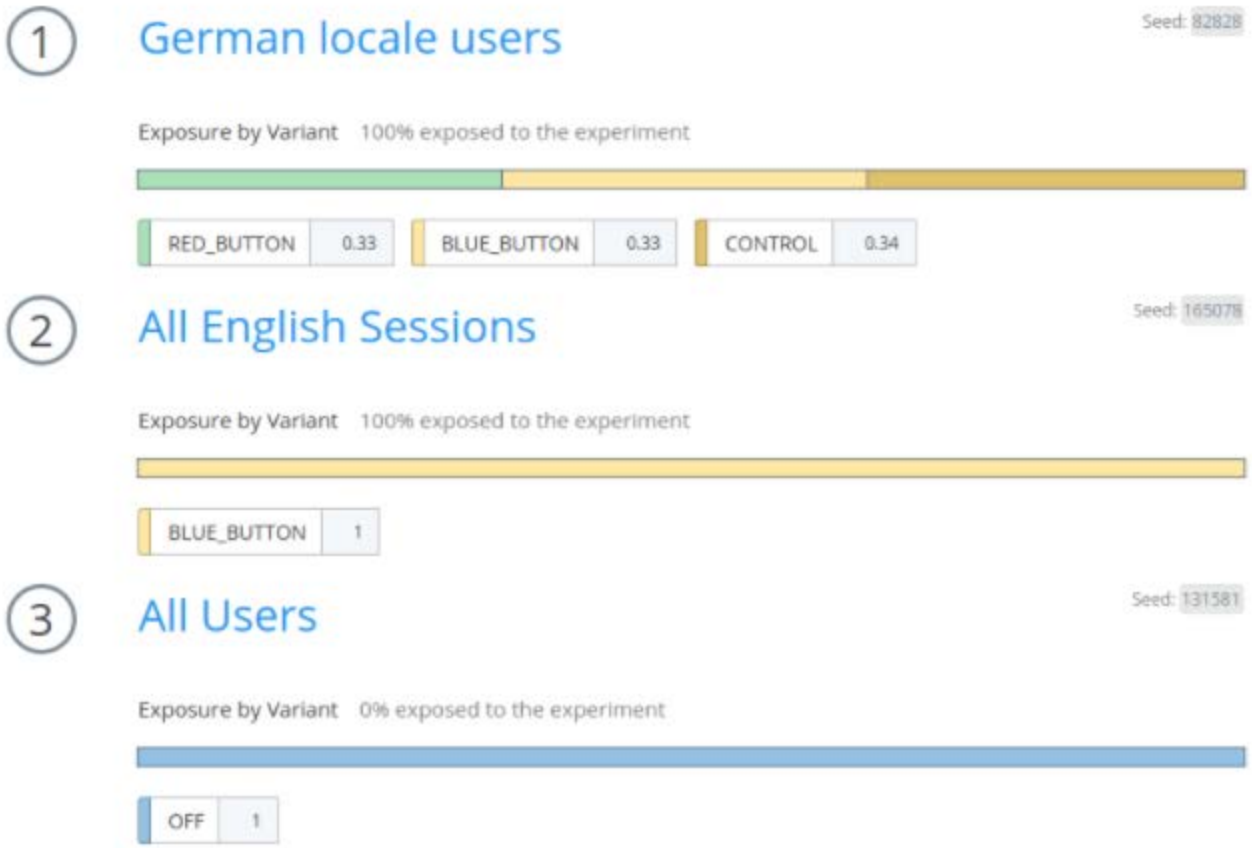
Traffic Splitting

Experimentation Platform Stormcrow: Feature Gate

```
# Here we are in some Dropbox Python code.
# We need to decide whether to show a red button or a blue button to the user.
# Let's ask Stormcrow!
variant = stormcrow.get_variant("feature_x", user=the_user)
if variant == "RED_BUTTON":
  show_red_button()
elif variant == "BLUE_BUTTON"
  show_blue_button()
else:
  show_default_button()
```

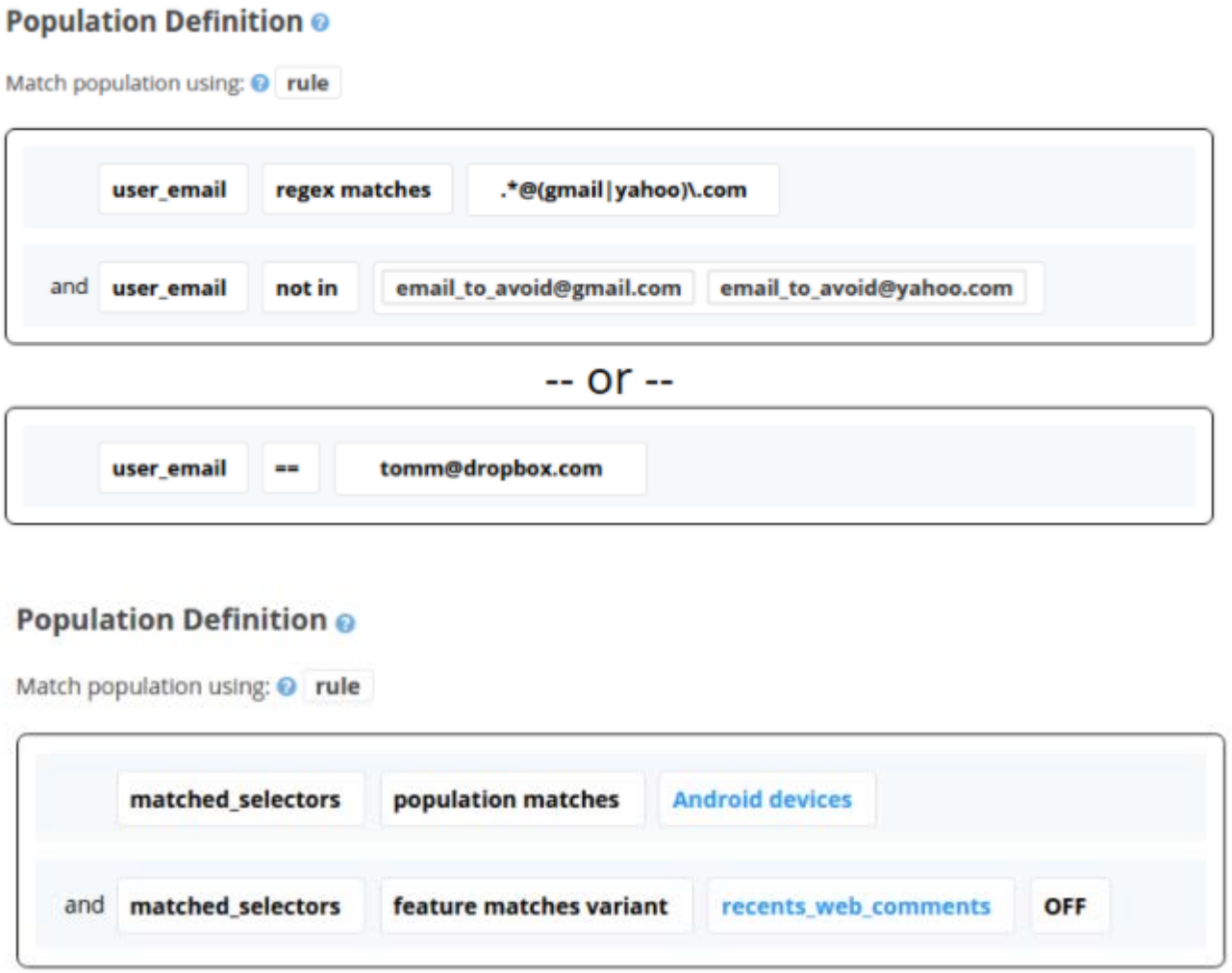
Dropbox

Stormcrow: Feature Configuration



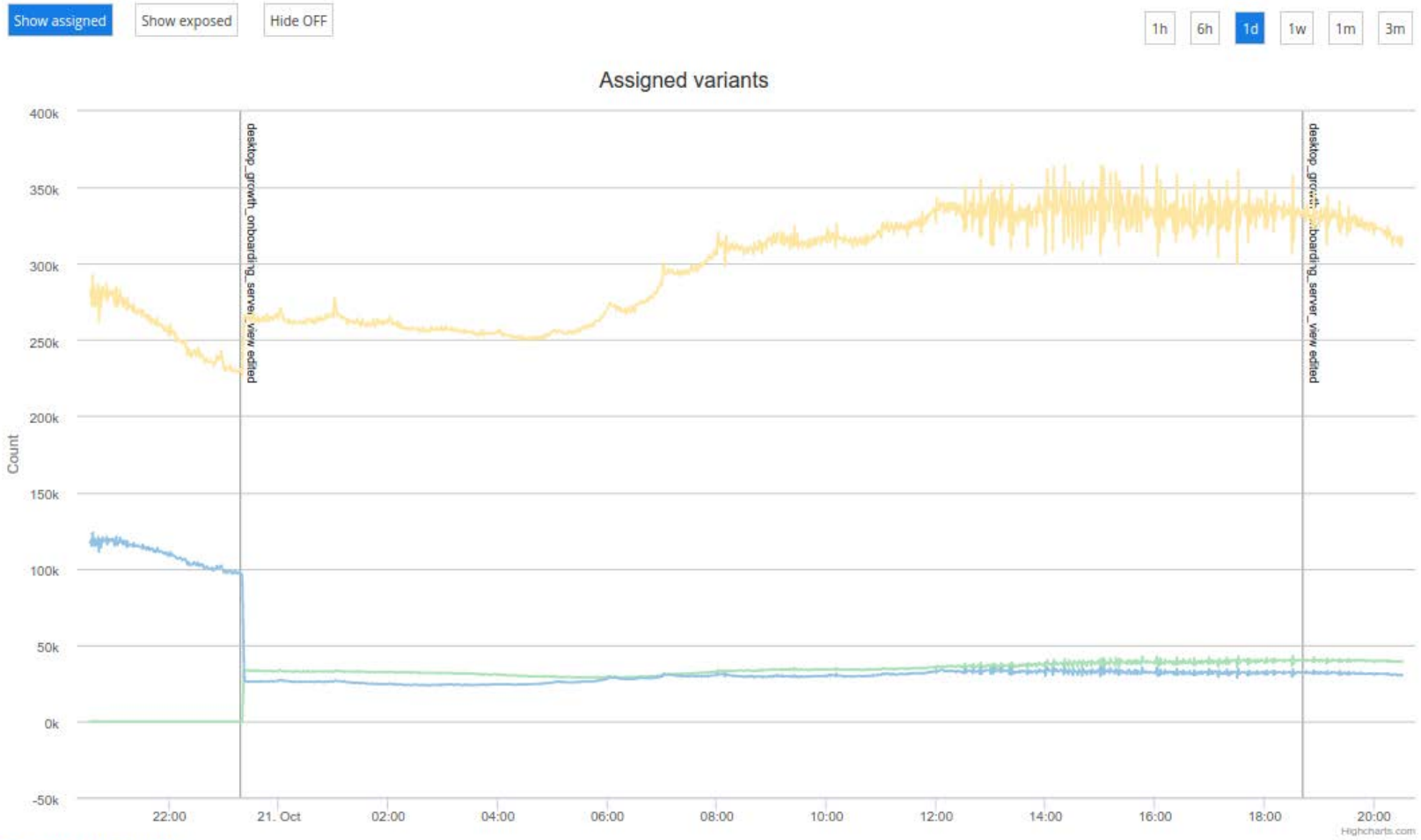
Dropbox

Stormcrow: Population Definition



Dropbox

Stormcrow: Monitoring



Dropbox

Experimentation in DSL Engineering: Goals and Hypotheses

Abstract This paper presents a controlled experiment...

Goals

G1: **Analyze** the efficiency of similar test DSLs
for the purpose of evaluation
with respect to creation time
from the point of view of a DSL user
in the context of graduate students using assisting editors for test case creation.

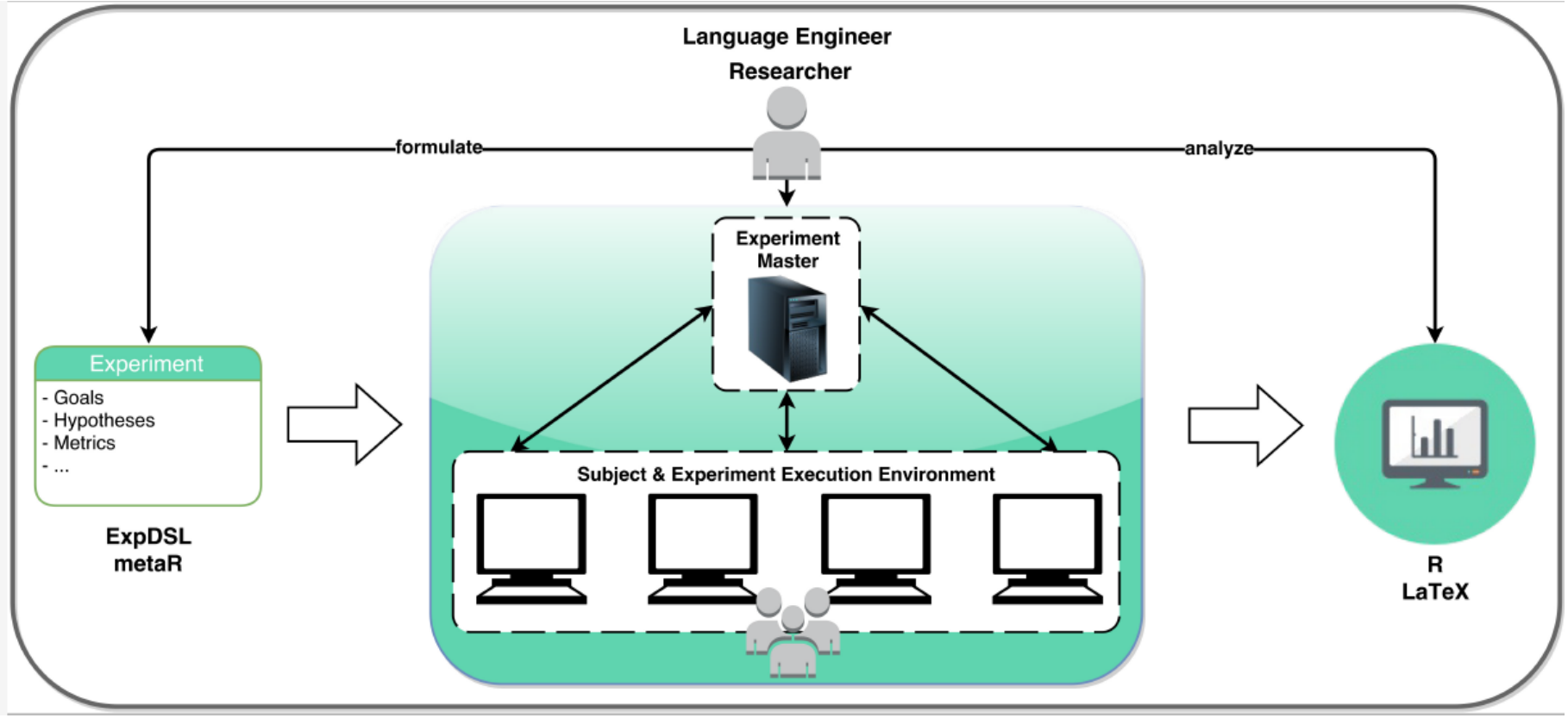
Hypotheses

H0: The time to create tests with both DSLs is equal

H1: The time to create tests differs significantly

F. Häser, M. Felderer, R. Breu: Is business domain language support beneficial for creating test case specifications: A controlled experiment. Information & Software Technology 79: 52-62 (2016)

Experimental in DSL Engineering: Environment

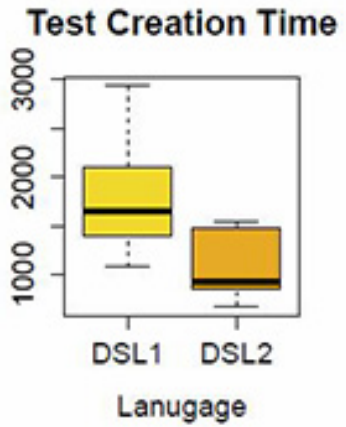


Experimentation in DSL Engineering: DSL for Experimentation

```
Experiment Domain-Aware Language Efficiency
  Statistical Analysis
  import vector timeMeasurements.csv
  test t ( DSL1 DSL2 ) alternative greater
  boxplot with DSL1 DSL2 BoxPlotSt
    names DSL1, DSL2
    col gold, orange
    title Test Creation Time
    x-label Language ]
```

greater
less

Hide Preview



Research Challenges

Automation of Requirements Testing

Patterns for Live Experimentation

Experimentation in Heterogeneous Environments

Internal Experimentation

Non-Functional Issues of Experimentation (Privacy, Performance)

Experimentation in a Systems Context