Crowdsourcing Software Engineering

SWE 795, Fall 2019
Software Engineering Environments

GEORGE MASON UNIVERSITY

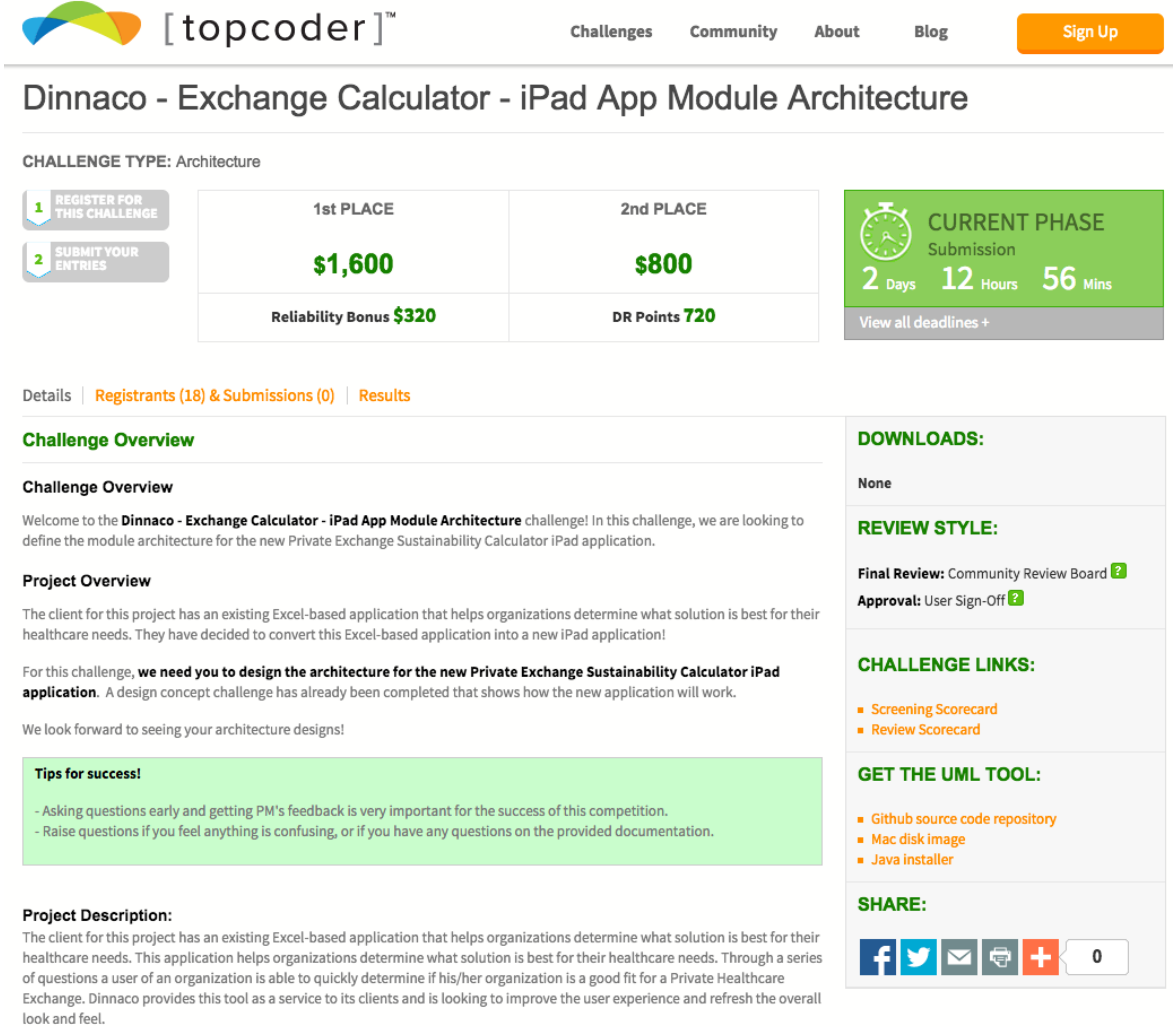
Today

- Part 1 (Lecture)(~80 mins)
- Break!
- Part 2 (Discussion)(~60 mins)
  - Discussion of readings

Open Source Software Development

Linux

Firefox


[topcoder]™

Challenges Community About Blog Sign Up

Dinnaco - Exchange Calculator - iPad App Module Architecture

CHALLENGE TYPE: Architecture

1 REGISTER FOR THIS CHALLENGE

2 SUBMIT YOUR ENTRIES

1st PLACE	2nd PLACE
$1,600	$800
Reliability Bonus $320	DR Points 720

CURRENT PHASE
Submission
2 Days 12 Hours 56 Mins
View all deadlines +

Details | Registrants (18) & Submissions (0) | Results

Challenge Overview

Challenge Overview

Welcome to the **Dinnaco - Exchange Calculator - iPad App Module Architecture** challenge! In this challenge, we are looking to define the module architecture for the new Private Exchange Sustainability Calculator iPad application.

Project Overview

The client for this project has an existing Excel-based application that helps organizations determine what solution is best for their healthcare needs. They have decided to convert this Excel-based application into a new iPad application!

For this challenge, **we need you to design the architecture for the new Private Exchange Sustainability Calculator iPad application**. A design concept challenge has already been completed that shows how the new application will work.

We look forward to seeing your architecture designs!

Tips for success!

- Asking questions early and getting PM's feedback is very important for the success of this competition.
- Raise questions if you feel anything is confusing, or if you have any questions on the provided documentation.

Project Description:

The client for this project has an existing Excel-based application that helps organizations determine what solution is best for their healthcare needs. This application helps organizations determine what solution is best for their healthcare needs. Through a series of questions a user of an organization is able to quickly determine if his/her organization is a good fit for a Private Healthcare Exchange. Dinnaco provides this tool as a service to its clients and is looking to improve the user experience and refresh the overall look and feel.

DOWNLOADS:

None

REVIEW STYLE:

Final Review: Community Review Board

Approval: User Sign-Off

CHALLENGE LINKS:

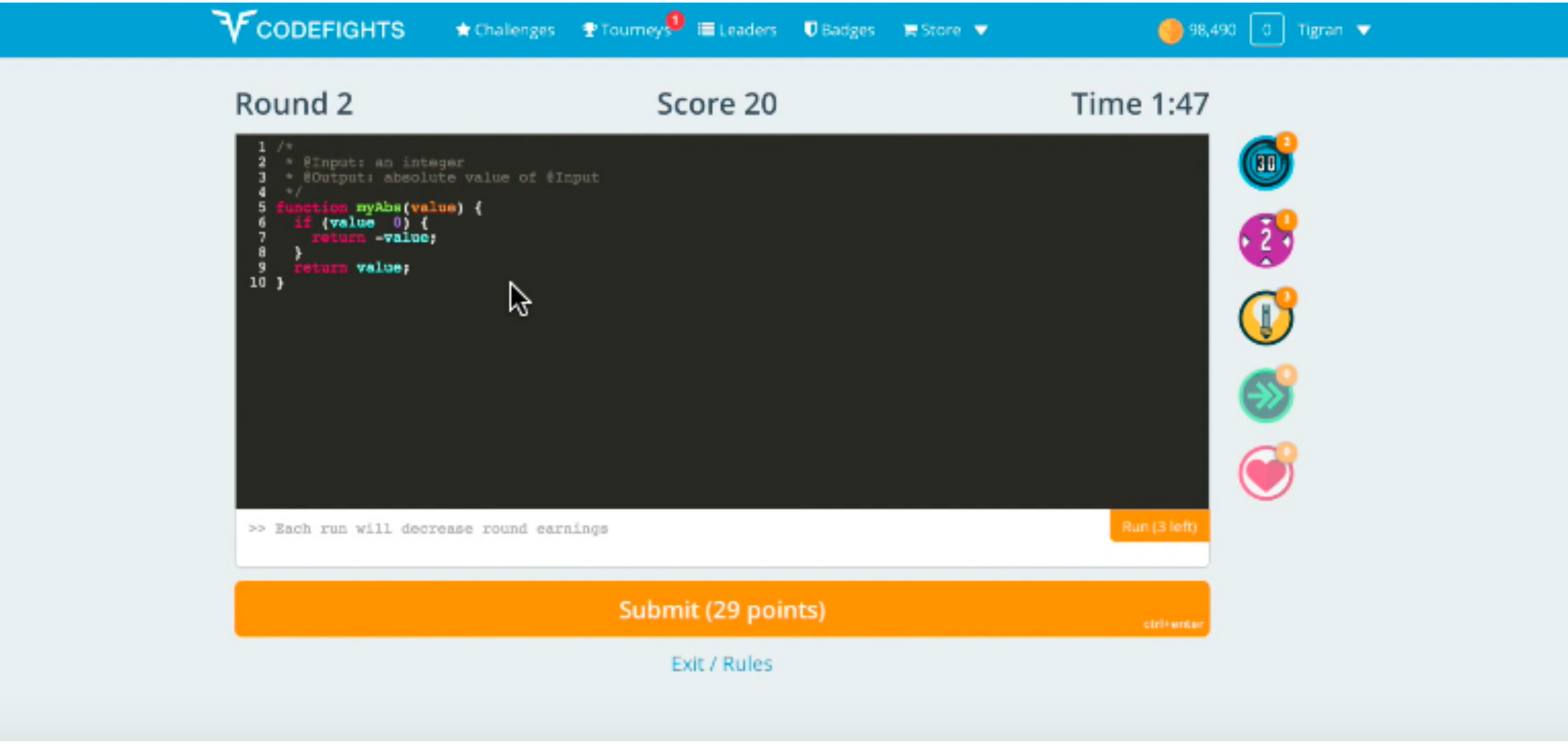
- Screening Scorecard
- Review Scorecard

GET THE UML TOOL:

- Github source code repository
- Mac disk image
- Java installer

SHARE:

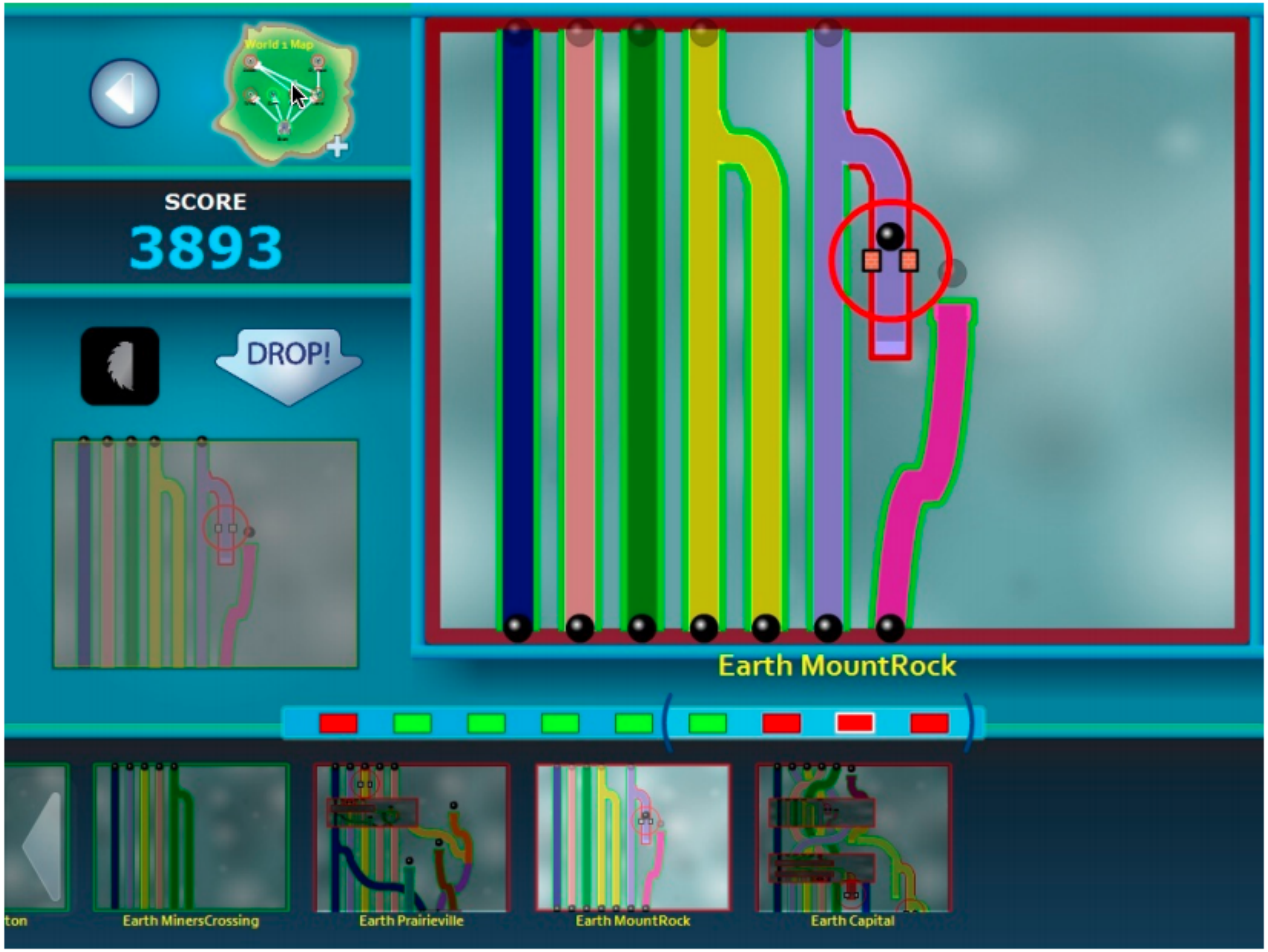
0



```
/*
 * @Input: an integer
 * @Output: absolute value of @Input
 */
function myAbs(value) {
  if (value  0) {
    return -value;
  }
  return value;
}
```

```
>> Each run will decrease round earnings
```

Games with a Purpose (Pipejam)



Werner Dietl, Stephanie Dietzel, Michael D. Ernst, Nathaniel Mote, Brian Walker, Seth Cooper, Timothy Pavlik, and Zoran Popović. 2012. Verification games: making verification fun. In Proceedings of the 14th Workshop on Formal Techniques for Java-like Programs (FTfJP '12). ACM, New York, NY, USA, 42-49. DOI=http://dx.doi.org/10.1145/2318202.2318210

PipeJam

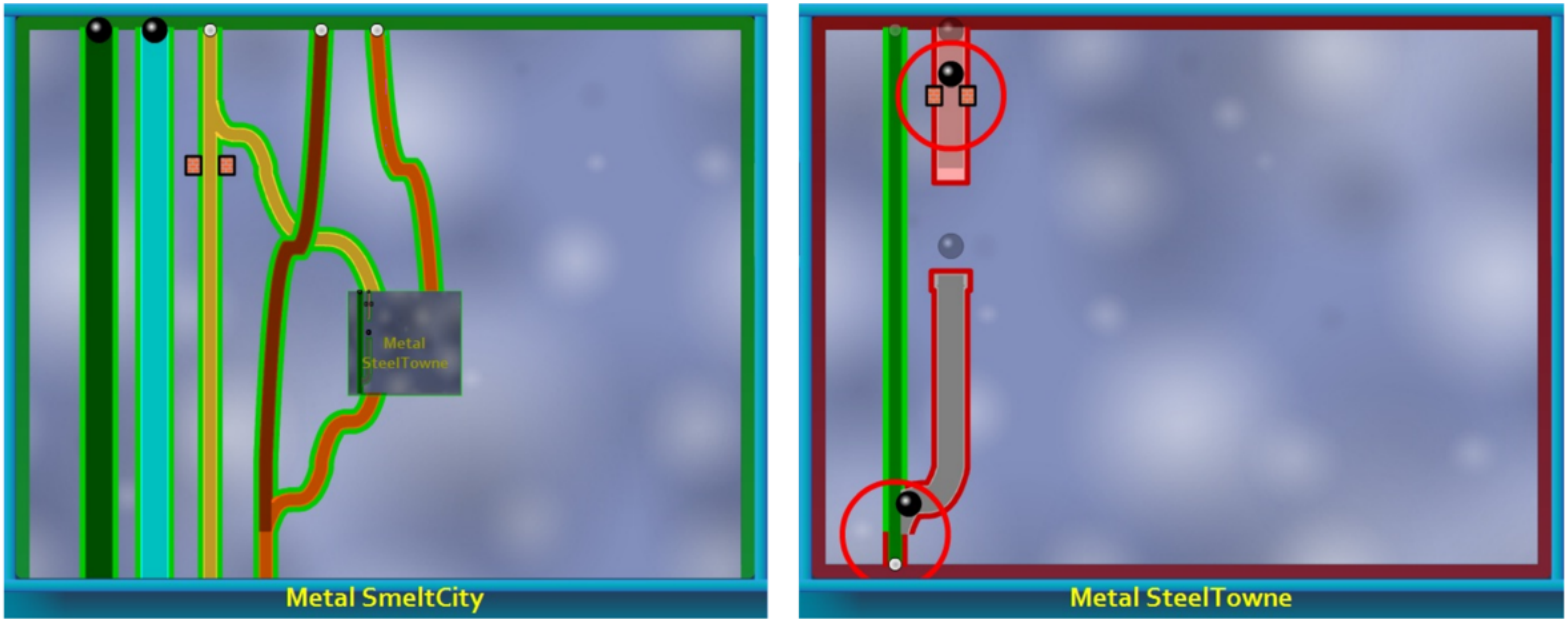


Figure 2: Detail of two boards from the Pipe Jam game shown in Figure 1. The left board demonstrates wide and narrow pipes, pinch points, a merge (near the bottom center), and a subnetwork. The right board demonstrates two collisions, each of which prevents the game from being solved. At the top, a large ball collides with a pinch point. At the bottom, a wide ball gets stuck trying to merge into a narrow pipe. The collisions are highlighted by red circles. A pipe segment is outlined in green if it contains no collision, and in red if it contains a collision. The gray pipe on the right board cannot be adjusted in width.

Crowdsourcing - definition

The act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call.

[Howe 2006]

Crowdsourcing for software engineering - definition

The act of undertaking any **external software engineering tasks** by an undefined, potentially large group of online workers in an open call format.

[Mao+ 2015]

Some crowdsourcing models

Wisdom of the crowds (e.g., prediction markets)
aggregating information from diverse participants

Peer production (e.g., **Wikipedia)**
decentralized goal setting

Microtasking (**Mechanical Turk)**
short, self contained parallelizable tasks

Human computation / Games with a purpose
dual-sided value creation through play

Online labor markets
fluid labor forces, recruiting specialists

Dimensions of software crowdsourcing

Dimension	Explanation	Range
crowd size	**size** of the crowd necessary to effectively tackle the problem	small to large
task length	amount of **time** a worker spends completing an individual task	minutes to weeks
expertise demands	level of **domain** familiarity required for a worker to make a contribution	minimal to extensive
locus of control	**ownership** over the creation of new (sub)tasks	client to workers
incentives	**motivational** factors that cause workers to engage with the task	intrinsic to extrinsic
task interdependence	degree to which tasks within the overall workflow build on each other	low to high
task context	amount of **system information** a worker must know to contribute	none to extensive
replication	the number of times the same task may be **redundantly** completed	none to many

LaToza and van der Hoek. Crowdsourcing for Software Engineering: Models, Opportunities, Challenges. IEEE Software, Jan/Feb 2016.

Dimensions of PipeJam

Crowd size: medium

Task length: minutes

Expertise demands: minimal

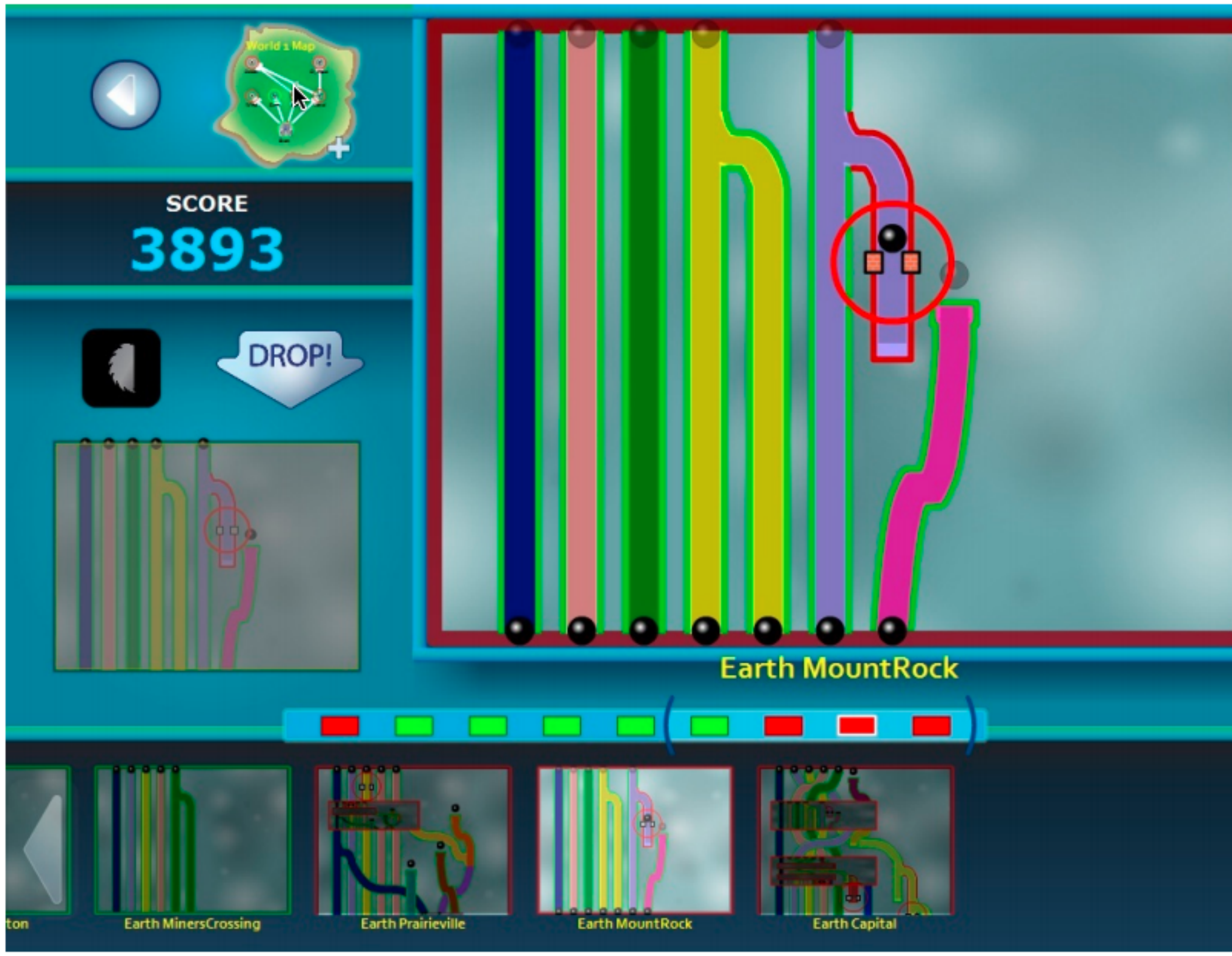
Locus of control: client

Incentives: intrinsic

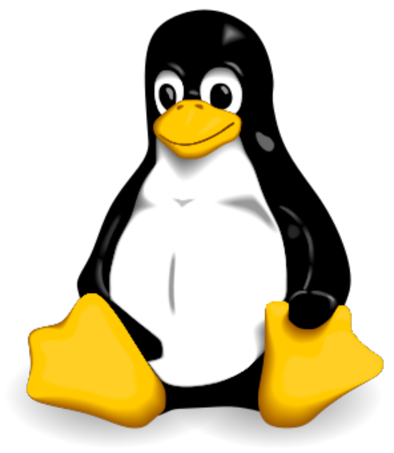
Task interdependence: medium

Task context: none

Replication: none



Locus of control & incentives

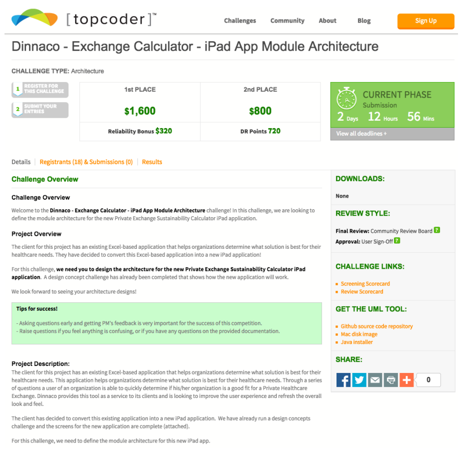


Crowd & Intrinsic

OSS

Q&A sites (StackOverflow)

Gamified programming



Dinnaco - Exchange Calculator - iPad App Module Architecture

CHALLENGE TYPE: Architecture

1st PLACE	2nd PLACE
$1,600	$800
Reliability Bonus $320	DR Points 720

CURRENT PHASE
Submission
2 Days 12 Hours 56 Mins

Challenge Overview

Challenge Overview

Welcome to the **Dinnaco - Exchange Calculator - iPad App Module Architecture** challenge! In this challenge, we are looking to define the module architecture for the new Private Exchange Sustainability Calculator iPad application.

Project Overview

The client for this project has an existing Excel-based application that helps organizations determine what solution is best for their healthcare needs. They have decided to convert this Excel-based application into a new iPad application!

For this challenge, **we need you to design the architecture for the new Private Exchange Sustainability Calculator iPad application**. A design concept challenge has already been completed that shows how the new application will work.

We look forward to seeing your architecture designs!

Tips for success!

- Asking questions early and getting PM's feedback is very important for the success of this competition.
- Raise questions if you feel anything is confusing, or if you have any questions on the provided documentation.

Project Description:
The client for this project has an existing Excel-based application that helps organizations determine what solution is best for their healthcare needs. This application helps organizations determine what solution is best for their healthcare needs. Through a series of questions a user of an organization is able to quickly determine if his/her organization is a good fit for a Private Healthcare Exchange. Dinnaco provides this tool as a service to its clients and is looking to improve the user experience and refresh the overall look and feel.

The client has decided to convert this existing application into a new iPad application. We have already run a design concepts challenge and the screens for the new application are complete (attached).

For this challenge, we need to define the module architecture for this new iPad app.

DOWNLOADS:

None

REVIEW STYLE:

Final Review: Community Review Board

Approval: User Sign-Off

CHALLENGE LINKS:

- Screening Scorecard
- Review Scorecard

GET THE UML TOOL:

- Github source code repository
- Mac disk image
- Java installer

SHARE:

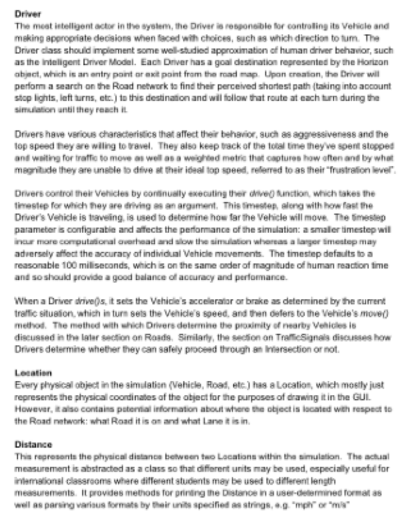
0

Client & Extrinsic

Competitions

Labor markets

Replication



Driver
The most intelligent actor in the system, the Driver is responsible for controlling its Vehicle and making appropriate decisions when faced with choices, such as which direction to turn. The Driver class should implement some well-studied approximation of human driver behavior, such as the Intelligent Driver Model. Each Driver has a goal destination represented by the Horizon object, which is an entry point or exit point from the road map. Upon creation, the Driver will perform a search on the Road network to find their perceived shortest path (taking into account stop lights, left turns, etc.) to this destination and will follow that route at each turn during the simulation until they reach it.

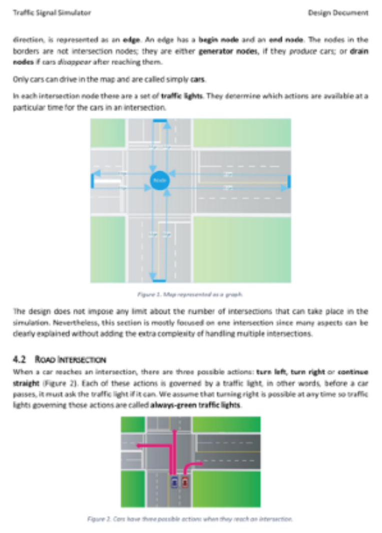
Drivers have various characteristics that affect their behavior, such as aggressiveness and the top speed they are willing to travel. They also keep track of the total time they've spent stopped and waiting for traffic to move as well as a weighted metric that captures how often and by what magnitude they are unable to drive at their ideal top speed, referred to as their "frustration level".

Drivers control their Vehicles by continually executing their *drive()* function, which takes the timestep for which they are driving as an argument. This timestep, along with how fast the Driver's Vehicle is traveling, is used to determine how far the Vehicle will move. The timestep parameter is configurable and affects the performance of the simulation: a smaller timestep will incur more computational overhead and slow the simulation whereas a larger timestep may adversely affect the accuracy of individual Vehicle movements. The timestep defaults to a reasonable 100 milliseconds, which is on the same order of magnitude of human reaction time and so should provide a good balance of accuracy and performance.

When a Driver *drive()s*, it sets the Vehicle's accelerator or brake as determined by the current traffic situation, which in turn sets the Vehicle's speed, and then defers to the Vehicle's *move()* method. The method with which Drivers determine the proximity of nearby Vehicles is discussed in the later section on Roads. Similarly, the section on TrafficSignals discusses how Drivers determine whether they can safely proceed through an Intersection or not.

Location
Every physical object in the simulation (Vehicle, Road, etc.) has a Location, which mostly just represents the physical coordinates of the object for the purposes of drawing it in the GUI. However, it also contains potential information about where the object is located with respect to the Road network: what Road it is on and what Lane it is in.

Distance
This represents the physical distance between two Locations within the simulation. The actual measurement is abstracted as a class so that different units may be used, especially useful for international classrooms where different students may be used to different length measurements. It provides methods for printing the Distance in a user-determined format as well as parsing various formats by their units specified as strings, e.g. "mph" or "m/s"



Traffic Signal Simulator — Design Document

direction, is represented as an **edge**. An edge has a **begin node** and an **end node**. The nodes in the borders are not intersection nodes; they are either **generator nodes**, if they *produce* cars; or **drain nodes** if cars *disappear* after reaching them.

Only cars can drive in the map and are called simply **cars**.

In each intersection node there are a set of **traffic lights**. They determine which actions are available at a particular time for the cars in an intersection.

Figure 1. Map represented as a graph.

The design does not impose any limit about the number of intersections that can take place in the simulation. Nevertheless, this section is mostly focused on one intersection since many aspects can be clearly explained without adding the extra complexity of handling multiple intersections.

4.2 Road Intersection

When a car reaches an intersection, there are three possible actions: **turn left, turn right** or **continue straight** (Figure 2). Each of these actions is governed by a traffic light, in other words, before a car passes, it must ask the traffic light if it can. We assume that turning right is possible at any time so traffic lights governing those actions are called **always-green traffic lights**.

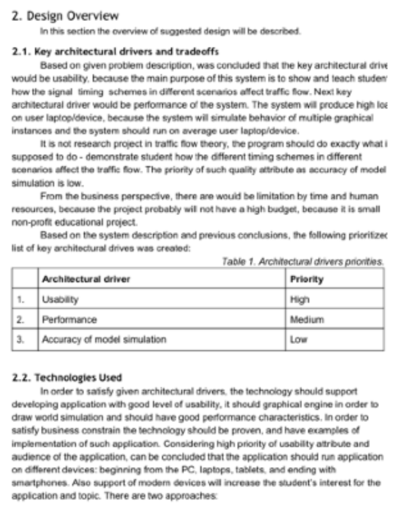
Figure 2. Cars have three possible actions when they reach an intersection.

Prototype

The following image shows a high level mock up of how TrafficSim looks like. This is a first cut design trying to capture and show the various elements of the use-case in a holistic view. This will be referred to in the detailed design later.

Figure 1 UI Mockup of TrafficSim

The post-it notes above explain provide more detail about what the mockup is showing. You may have to zoom in further to read it.



2. Design Overview

In this section the overview of suggested design will be described.

2.1. Key architectural drivers and tradeoffs

Based on given problem description, was concluded that the key architectural drive would be usability, because the main purpose of this system is to show and teach studen how the signal timing schemes in different scenarios affect traffic flow. Next key architectural driver would be performance of the system. The system will produce high loa on user laptop/device, because the system will simulate behavior of multiple graphical instances and the system should run on average user laptop/device.

It is not research project in traffic flow theory, the program should do exactly what i supposed to do - demonstrate student how the different timing schemes in different scenarios affect the traffic flow. The priority of such quality attribute as accuracy of model simulation is low.

From the business perspective, there are would be limitation by time and human resources, because the project probably will not have a high budget, because it is small non-profit educational project.

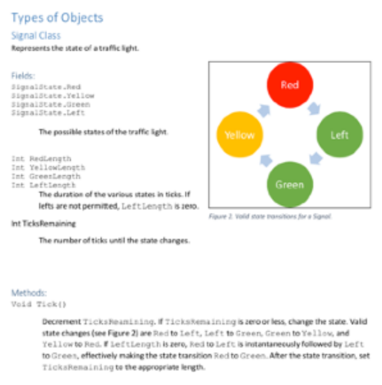
Based on the system description and previous conclusions, the following prioritize list of key architectural drives was created:

Table 1. Architectural drivers priorities.

	Architectural driver	Priority
1.	Usability	High
2.	Performance	Medium
3.	Accuracy of model simulation	Low

2.2. Technologies Used

In order to satisfy given architectural drivers, the technology should support developing application with good level of usability, it should graphical engine in order to draw world simulation and should have good performance characteristics. In order to satisfy business constrain the technology should be proven, and have examples of implementation of such application. Considering high priority of usability attribute and audience of the application, can be concluded that the application should run application on different devices: beginning from the PC, laptops, tablets, and ending with smartphones. Also support of modern devices will increase the student's interest for the application and topic. There are two approaches:



Types of Objects

Signal Class

Represents the state of a traffic light.

Fields:

```
SignalState.Red
SignalState.Yellow
SignalState.Green
SignalState.Left
```

The possible states of the traffic light.

```
Int RedLength
Int YellowLength
Int GreenLength
Int LeftLength
```

The duration of the various states in ticks. If lefts are not permitted, `LeftLength` is zero.

Int TicksRemaining

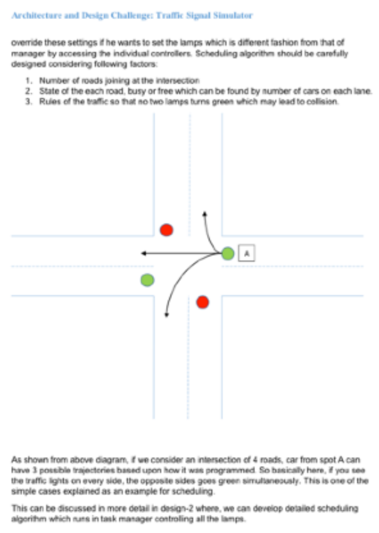
The number of ticks until the state changes.

Figure 2. Valid state transitions for a Signal.

Methods:

```
Void Tick()
```

Decrement `TicksRemaining`. If `TicksRemaining` is zero or less, change the state. Valid state changes (see Figure 2) are `Red` to `Left`, `Left` to `Green`, `Green` to `Yellow`, and `Yellow` to `Red`. If `LeftLength` is zero, `Red` to `Left` is instantaneously followed by `Left` to `Green`, effectively making the state transition `Red` to `Green`. After the state transition, set `TicksRemaining` to the appropriate length.



Architecture and Design Challenge: Traffic Signal Simulator

override these settings if he wants to set the lamps which is different fashion from that of manager by accessing the individual controllers. Scheduling algorithm should be carefully designed considering following factors:

1. Number of roads joining at the intersection
2. State of the each road, busy or free which can be found by number of cars on each lane.
3. Rules of the traffic so that no two lamps turns green which may lead to collision.

As shown from above diagram, if we consider an intersection of 4 roads, car from spot A can have 3 possible trajectories based upon how it was programmed. So basically here, if you see the traffic lights on every side, the opposite sides goes green simultaneously. This is one of the simple cases explained as an example for scheduling.

This can be discussed in more detail in design-2 where, we can develop detailed scheduling algorithm which runs in task manager controlling all the lamps.

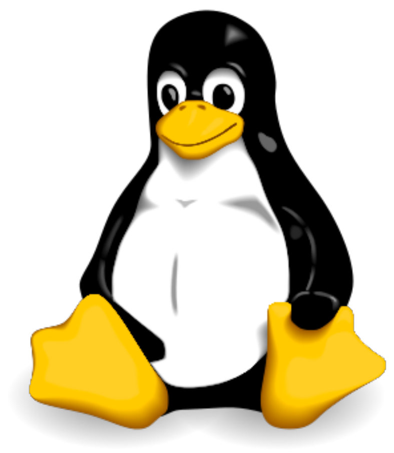
Whole project (OSS)

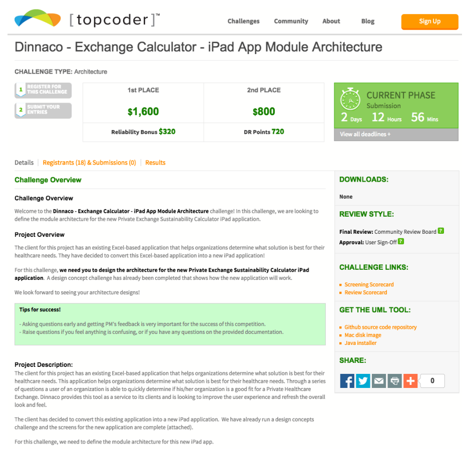
Derivative projects (OSS)

Work items (Competitions)

Design decisions (Q&A sites)

Task length & Task context





[topcoder]™ Challenges Community About Blog Sign Up

Dinnaco - Exchange Calculator - iPad App Module Architecture

CHALLENGE TYPE: Architecture

1 REGISTER FOR THIS CHALLENGE
2 SUBMIT YOUR ENTRIES

1st PLACE	2nd PLACE
$1,600	$800
Reliability Bonus $320	DR Points 720

CURRENT PHASE
Submission
2 Days 12 Hours 56 Mins
View all deadlines +

Details | Registrants (18) & Submissions (0) | Results

Challenge Overview

Challenge Overview

Welcome to the **Dinnaco - Exchange Calculator - iPad App Module Architecture** challenge! In this challenge, we are looking to define the module architecture for the new Private Exchange Sustainability Calculator iPad application.

Project Overview

The client for this project has an existing Excel-based application that helps organizations determine what solution is best for their healthcare needs. They have decided to convert this Excel-based application into a new iPad application!

For this challenge, **we need you to design the architecture for the new Private Exchange Sustainability Calculator iPad application**. A design concept challenge has already been completed that shows how the new application will work.

We look forward to seeing your architecture designs!

Tips for success!

- Asking questions early and getting PM's feedback is very important for the success of this competition.
- Raise questions if you feel anything is confusing, or if you have any questions on the provided documentation.

Project Description:

The client for this project has an existing Excel-based application that helps organizations determine what solution is best for their healthcare needs. This application helps organizations determine what solution is best for their healthcare needs. Through a series of questions a user of an organization is able to quickly determine if his/her organization is a good fit for a Private Healthcare Exchange. Dinnaco provides this tool as a service to its clients and is looking to improve the user experience and refresh the overall look and feel.

The client has decided to convert this existing application into a new iPad application. We have already run a design concepts challenge and the screens for the new application are complete (attached).

For this challenge, we need to define the module architecture for this new iPad app.

DOWNLOADS:
None

REVIEW STYLE:
Final Review: Community Review Board
Approval: User Sign-Off

CHALLENGE LINKS:
- Screening Scorecard
- Review Scorecard

GET THE UML TOOL:
- Github source code repository
- Mac disk image
- Java installer

SHARE:
0

stackoverflow

Long (hours - weeks) & High

OSS

Competitions

Labor markets

(Software development work)

Short (minutes) & Low

Gamified programming

Q&A sites

Labor markets for testing

(Tasks w/ clear goals)

Examples of software crowdsourcing platforms

Dimension	Open source	TopCoder	UserTesting.com
crowd size	small – medium	small	medium
task length	hours – days	days - week	minutes
expertise demands	moderate	extensive	minimal
locus of control	workers	client	client
incentives	intrinsic	extrinsic	extrinsic
task interdependence	moderate	low	low
task context	extensive	minimal	none
replication	none	several	many

Programming is becoming more social and fluid

stackoverflow

share hard-earned expertise

>7M monthly visits

codecademy

learn programming through structured examples

>24M users

github SOCIAL CODING

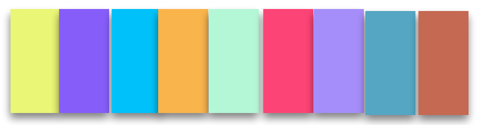
reputation made visible

>8M users

competitive programming duels

>100K users

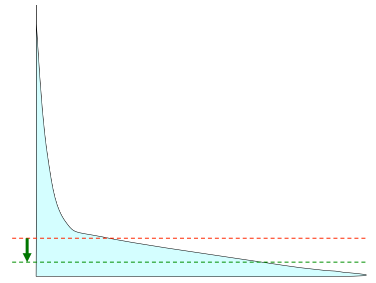
Crowdsourcing SE opportunities



(similar microtask, done for many tasks)

Extreme **specialization** - more effectively match workers to work

Worker might choose microtasks they most enjoy or most experienced.



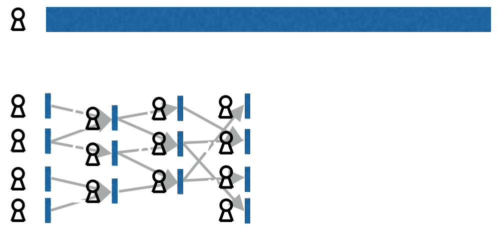
Increase **participation** by reducing contribution barriers

Expert developer might do a key microtask and contribute key insight.

Microtask design might enable non-programmer to do work.

Let developers **learn** while working

Novice selects microtasks related to learning objective.



Reduce **time** to market

Decomposing tasks into parallel microtasks reduces time.

More **fluid** software teams

Enable teams to hire experts for short engagements

Platform for data-driven SE research

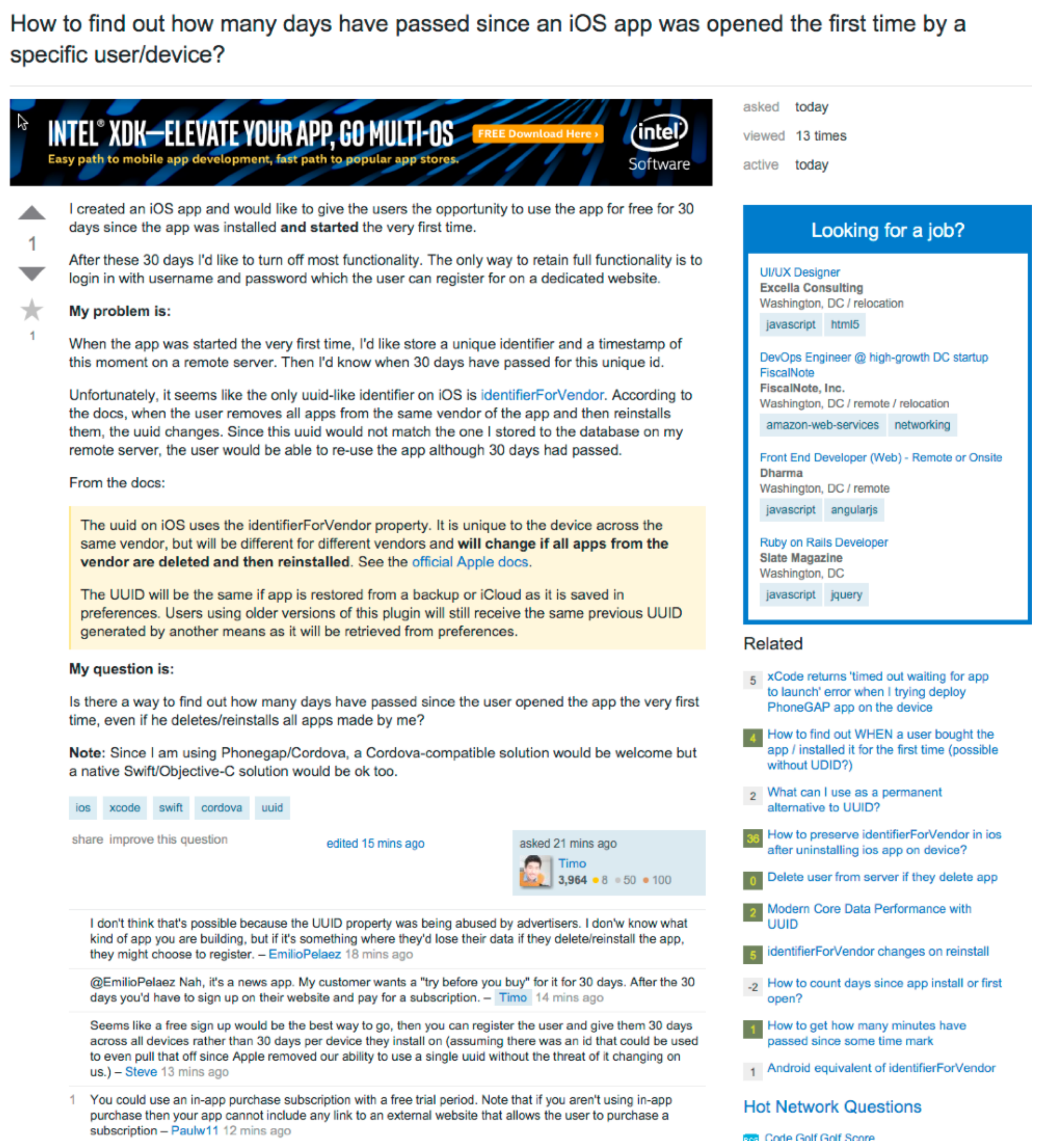
Produces archival data on structure of work inside tasks

Crowdsourcing SE topics today

- Peer production on Q&A sites (Stack Overflow)
- Sharing expertise
- Increasing parallelism in programming
- Replication & competition in software design
- Crowdsourcing systems for software design

Commons-Based Peer Production

- Community with distributed control where contributors, rather than a paying client, make decisions about scope and goals of project.
- Contributors may be motivated by opportunity for experience, reputation, altruism.



How to find out how many days have passed since an iOS app was opened the first time by a specific user/device?

INTEL® XDK—ELEVATE YOUR APP, GO MULTI-OS
FREE Download Here ›
Easy path to mobile app development, fast path to popular app stores.
intel Software

1

1

I created an iOS app and would like to give the users the opportunity to use the app for free for 30 days since the app was installed **and started** the very first time.

After these 30 days I'd like to turn off most functionality. The only way to retain full functionality is to login in with username and password which the user can register for on a dedicated website.

My problem is:

When the app was started the very first time, I'd like store a unique identifier and a timestamp of this moment on a remote server. Then I'd know when 30 days have passed for this unique id.

Unfortunately, it seems like the only uuid-like identifier on iOS is identifierForVendor. According to the docs, when the user removes all apps from the same vendor of the app and then reinstalls them, the uuid changes. Since this uuid would not match the one I stored to the database on my remote server, the user would be able to re-use the app although 30 days had passed.

From the docs:

> The uuid on iOS uses the identifierForVendor property. It is unique to the device across the same vendor, but will be different for different vendors and **will change if all apps from the vendor are deleted and then reinstalled**. See the official Apple docs.
>
> The UUID will be the same if app is restored from a backup or iCloud as it is saved in preferences. Users using older versions of this plugin will still receive the same previous UUID generated by another means as it will be retrieved from preferences.

My question is:

Is there a way to find out how many days have passed since the user opened the app the very first time, even if he deletes/reinstalls all apps made by me?

Note: Since I am using Phonegap/Cordova, a Cordova-compatible solution would be welcome but a native Swift/Objective-C solution would be ok too.

ios xcode swift cordova uuid

share improve this question edited 15 mins ago asked 21 mins ago Timo 3,964 ● 8 ● 50 ● 100

I don't think that's possible because the UUID property was being abused by advertisers. I don'w know what kind of app you are building, but if it's something where they'd lose their data if they delete/reinstall the app, they might choose to register. – EmilioPelaez 18 mins ago

@EmilioPelaez Nah, it's a news app. My customer wants a "try before you buy" for it for 30 days. After the 30 days you'd have to sign up on their website and pay for a subscription. – Timo 14 mins ago

Seems like a free sign up would be the best way to go, then you can register the user and give them 30 days across all devices rather than 30 days per device they install on (assuming there was an id that could be used to even pull that off since Apple removed our ability to use a single uuid without the threat of it changing on us.) – Steve 13 mins ago

1 You could use an in-app purchase subscription with a free trial period. Note that if you aren't using in-app purchase then your app cannot include any link to an external website that allows the user to purchase a subscription – Paulw11 12 mins ago

asked	today
viewed	13 times
active	today

Looking for a job?

UI/UX Designer
Excella Consulting
Washington, DC / relocation
javascript html5

DevOps Engineer @ high-growth DC startup FiscalNote
FiscalNote, Inc.
Washington, DC / remote / relocation
amazon-web-services networking

Front End Developer (Web) - Remote or Onsite
Dharma
Washington, DC / remote
javascript angularjs

Ruby on Rails Developer
Slate Magazine
Washington, DC
javascript jquery

Related

- 5 xCode returns 'timed out waiting for app to launch' error when I trying deploy PhoneGAP app on the device
- 4 How to find out WHEN a user bought the app / installed it for the first time (possible without UDID?)
- 2 What can I use as a permanent alternative to UUID?
- 36 How to preserve identifierForVendor in ios after uninstalling ios app on device?
- 0 Delete user from server if they delete app
- 2 Modern Core Data Performance with UUID
- 5 identifierForVendor changes on reinstall
- -2 How to count days since app install or first open?
- 1 How to get how many minutes have passed since some time mark
- 1 Android equivalent of identifierForVendor

Hot Network Questions

Code Golf Golf Score

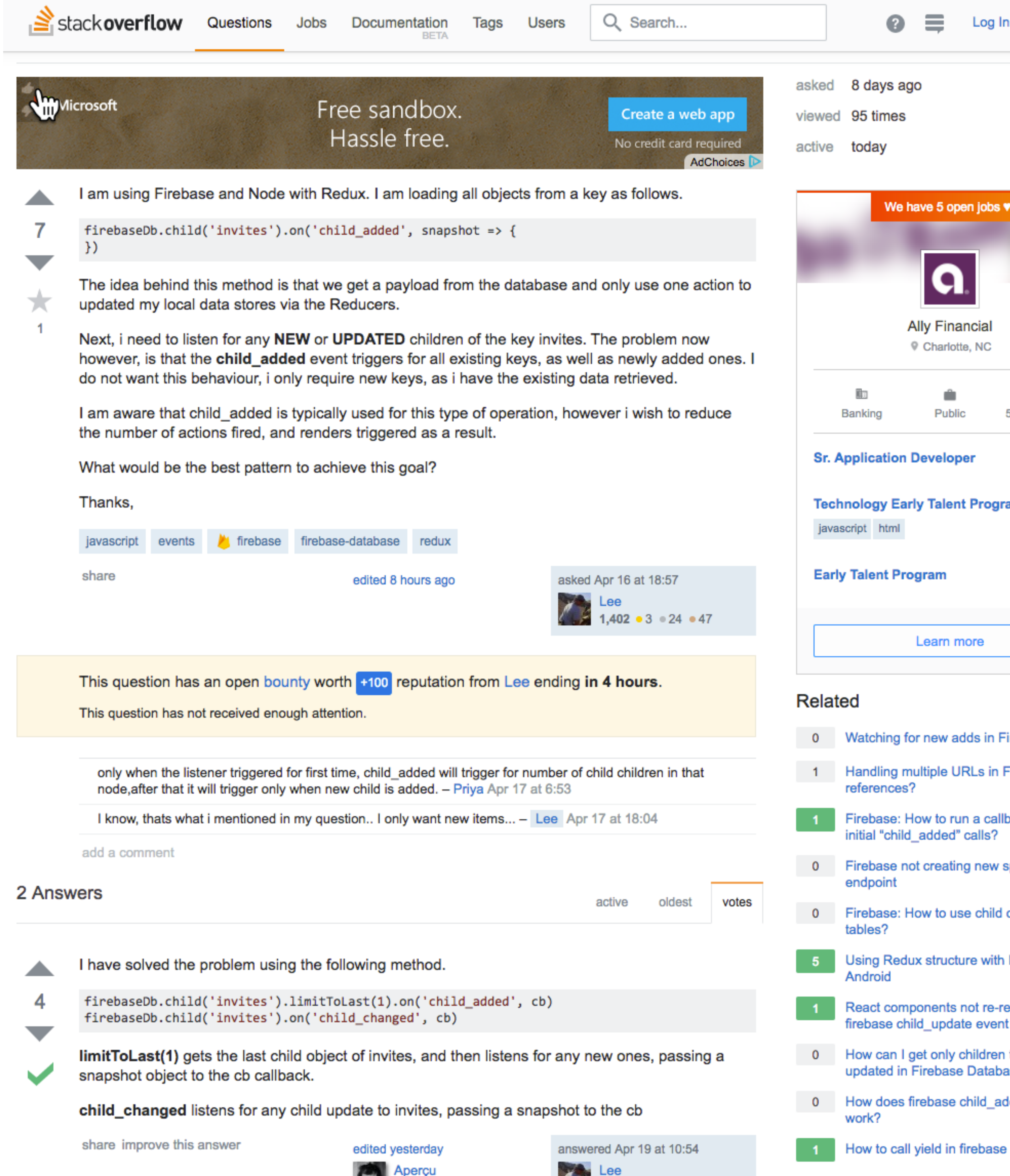
Mechanisms for soliciting contributions

- Key requirements
  - Output is decomposable into separate contribution units
  - Contributions are sufficiently fine-grained to capture contributions from those whose motivation will only sustain short efforts
  - Low cost mechanism defends against incompetent and malicious contributions

Y. Benkler and H. Nissenbaum, "Commons-based Peer Production and Virtue*," *J. Polit. Philos.*, vol. 14, no. 4, pp. 394– 419, 2006.

Stack Overflow

- >100M monthly unique visitors
- >3.9B yearly visits
- >3.7M questions asked



asked 8 days ago
viewed 95 times
active today

I am using Firebase and Node with Redux. I am loading all objects from a key as follows.

```
firebaseDb.child('invites').on('child_added', snapshot => {
})
```

The idea behind this method is that we get a payload from the database and only use one action to updated my local data stores via the Reducers.

Next, i need to listen for any **NEW** or **UPDATED** children of the key invites. The problem now however, is that the **child_added** event triggers for all existing keys, as well as newly added ones. I do not want this behaviour, i only require new keys, as i have the existing data retrieved.

I am aware that child_added is typically used for this type of operation, however i wish to reduce the number of actions fired, and renders triggered as a result.

What would be the best pattern to achieve this goal?

Thanks,

javascript events firebase firebase-database redux

share edited 8 hours ago asked Apr 16 at 18:57 Lee 1,402 ●3 ●24 ●47

7 1

This question has an open bounty worth +100 reputation from Lee ending **in 4 hours**.

This question has not received enough attention.

only when the listener triggered for first time, child_added will trigger for number of child children in that node,after that it will trigger only when new child is added. – Priya Apr 17 at 6:53

I know, thats what i mentioned in my question.. I only want new items... – Lee Apr 17 at 18:04

add a comment

2 Answers active oldest votes

4

I have solved the problem using the following method.

```
firebaseDb.child('invites').limitToLast(1).on('child_added', cb)
firebaseDb.child('invites').on('child_changed', cb)
```

limitToLast(1) gets the last child object of invites, and then listens for any new ones, passing a snapshot object to the cb callback.

child_changed listens for any child update to invites, passing a snapshot to the cb

share improve this answer edited yesterday Aperçu answered Apr 19 at 10:54 Lee

We have 5 open jobs
Ally Financial
Charlotte, NC
Banking Public
Sr. Application Developer
Technology Early Talent Progra
javascript html
Early Talent Program
Learn more

Related

0	Watching for new adds in Fi
1	Handling multiple URLs in F references?
1	Firebase: How to run a callb initial "child_added" calls?
0	Firebase not creating new s endpoint
0	Firebase: How to use child c tables?
5	Using Redux structure with Android
1	React components not re-re firebase child_update event
0	How can I get only children updated in Firebase Databa
0	How does firebase child_ad work?
1	How to call yield in firebase

Questions are answered quickly

- Median first answer 11 mins, accepted answer 21 mins

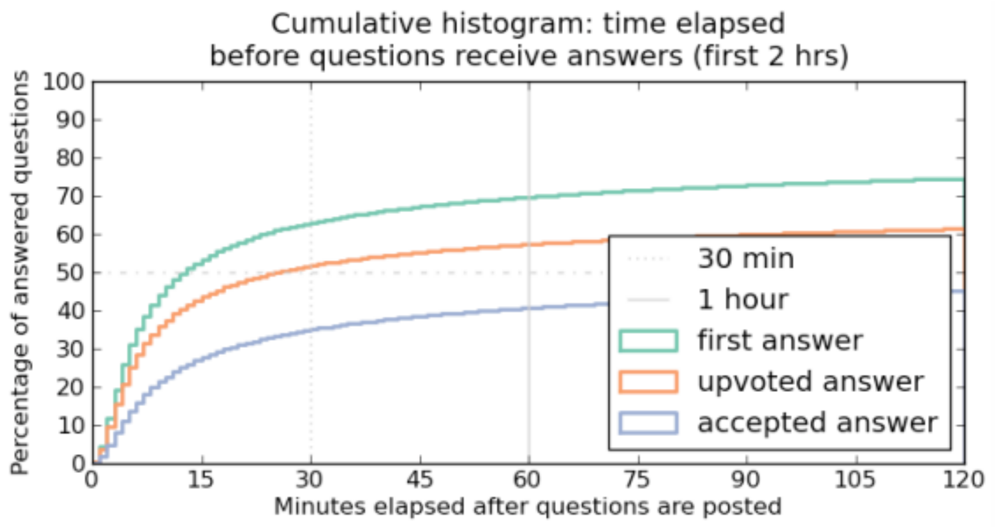


Figure 4: Answers in the 2 hours after questions are posted.

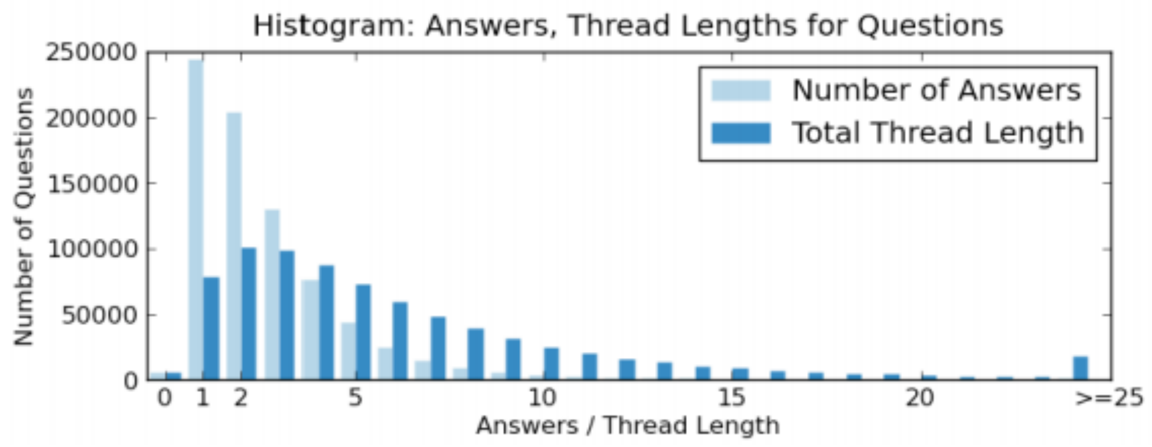


Figure 3: Answers and thread lengths for all questions.

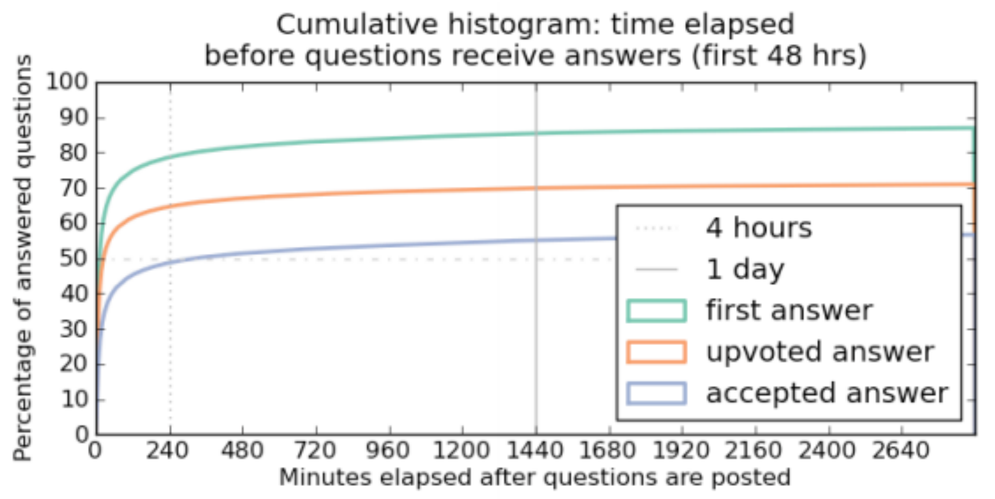


Figure 5: Answers in the first 2 days: little activity after 4 hrs.

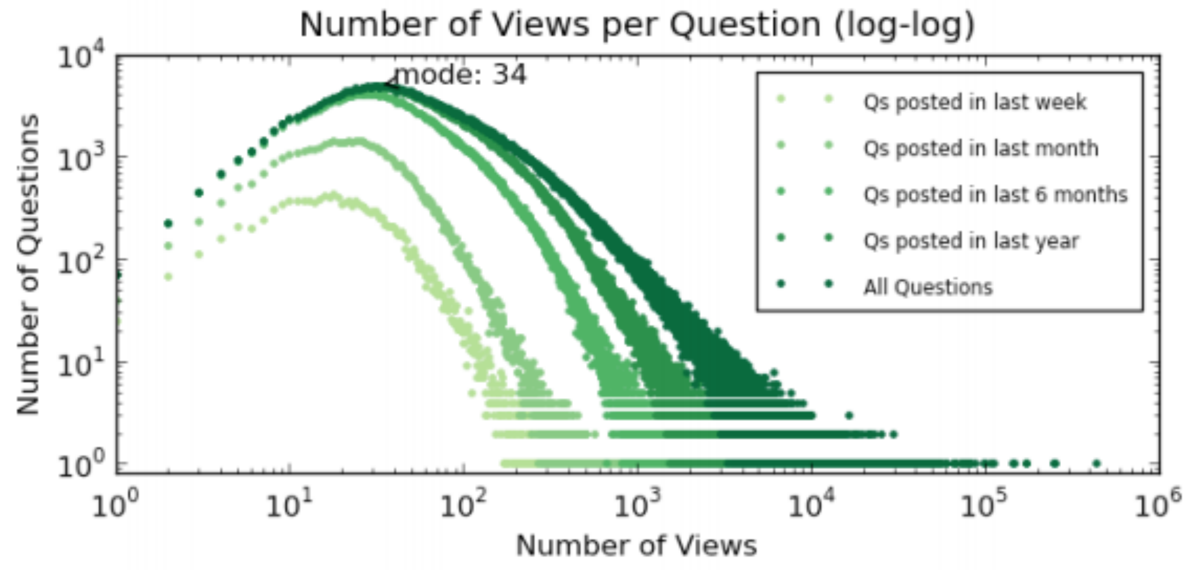


Figure 10: Questions receive dozens of views from visitors.

Lena Mamykina, Bella Manoim, Manas Mittal, George Hripcsak, and Björn Hartmann. 2011. Design lessons from the fastest q&a site in the west. *Conference on Human Factors in Computing Systems,* 2857-2866.

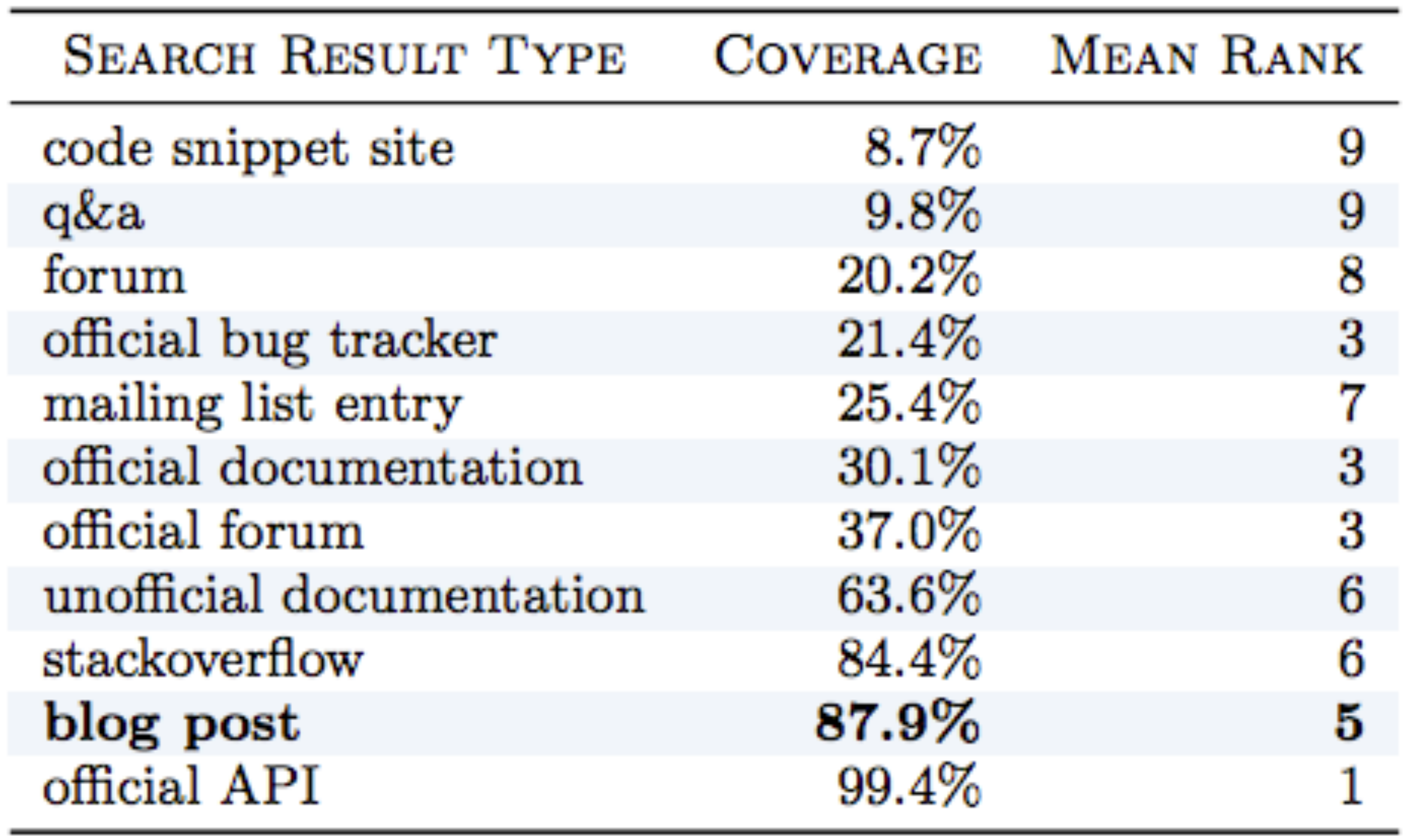
What makes StackOverflow work?

- Make competition productive
  - Tight focus on technical answers & voting system offered strong alternative to conversational forums
  - Game mechanisms through a reputation system led to intense participation
- Credibility in the community
  - Founders were thought leads that enabled them to gain a critical mass
- Evolutionary approach to design
  - Continuous feedback loop with users, helped prioritize feedback

Lena Mamykina, Bella Manoim, Manas Mittal, George Hripcsak, and Björn Hartmann. 2011. Design lessons from the fastest q&a site in the west. *Conference on Human Factors in Computing Systems,* 2857-2866.

Coverage of APIs

- Googled for all methods in jQuery API, examined top 10 links for type of result



Search Result Type	Coverage	Mean Rank
code snippet site	8.7%	9
q&a	9.8%	9
forum	20.2%	8
official bug tracker	21.4%	3
mailing list entry	25.4%	7
official documentation	30.1%	3
official forum	37.0%	3
unofficial documentation	63.6%	6
stackoverflow	84.4%	6
blog post	**87.9%**	**5**
official API	99.4%	1

Chris Parnin and Christoph Treude. 2011. Measuring API documentation on the web. *International Workshop on Web 2.0 for Software Engineering*, 25-30.

Sharing expertise

- Many developers do similar tasks everyday

- Write similar code —> code reuse
- Fix similar defects —> ???
- Do similar performance optimizations —> ???
- ….

- Can solve with StackOverflow, but requires developers to share knowledge & developer to find it
- Goals:
  - Increase breadth & quantity of expertise shared
  - Decrease time to access expertise
  - Increase probability that relevant expertise is found

On Demand Expert Assistance

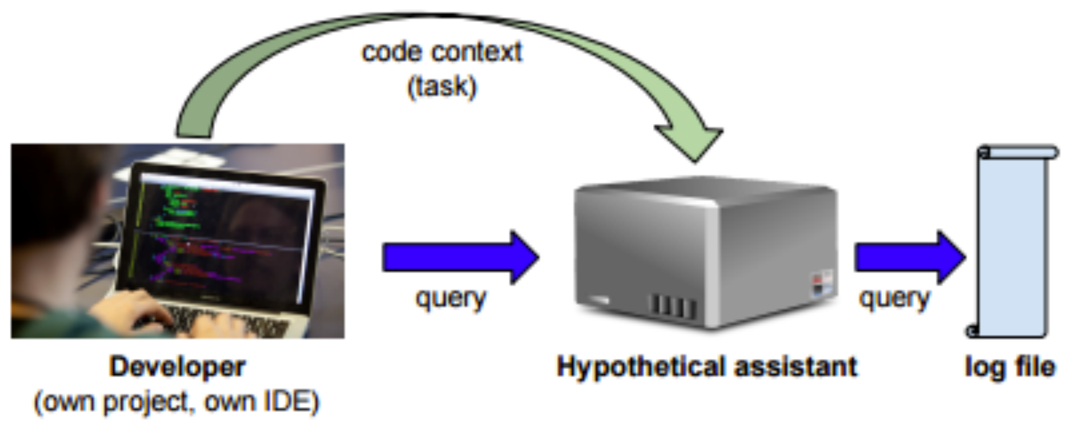


Figure 1. Setup for our hypothetical assistant study. Developer participants were asked to bring their own task to complete, and ask questions from our hypothetical assistant as if it could answer any support question needed. Participants were still allowed to use traditional online resources and augment them with the assistant as they saw fit. Context related to their programming task was collected at the beginning of each study, and audio of their questions was recorded during the session.

Description	# Sessions (out of 5)	# / Session
Memory Aids: Participants sought a specific function name	2	0.6
Explanatory Requests: Participants sought examples or explanations of their code	4	1.8
High-Level Strategic Guidance: Participants sought best ways to approach problems	5	4.6
Code Requests: Participants sought specific pieces of code	2	0.6
Bug Fixing: Participants sought specific solutions to program errors	2	1.0
Code Refactoring: Participants asked for code improvements	2	0.8
Effort-Saving Requests: Participants handed off tasks to save time and effort	4	4.0

Table 1. Common query types observed during our hypothetical assistant study, with corresponding frequencies. Each of these query types suggests a support role that remote software development assistants can play in future systems. "Number of Sessions" indicates the number of different sessions that each type of question occurred in, while "Number of Queries per Session" indicates the number of queries that referred to solving one of these query types, on average.

Y. Chen, S. Oney, **W.S. Lasecki**. (2016) Towards Providing On-Demand Expert Support for Software Developers. In *Proceedings of the ACM Conference on Human Factors in Computing Systems.*

On Demand Expert Assistance

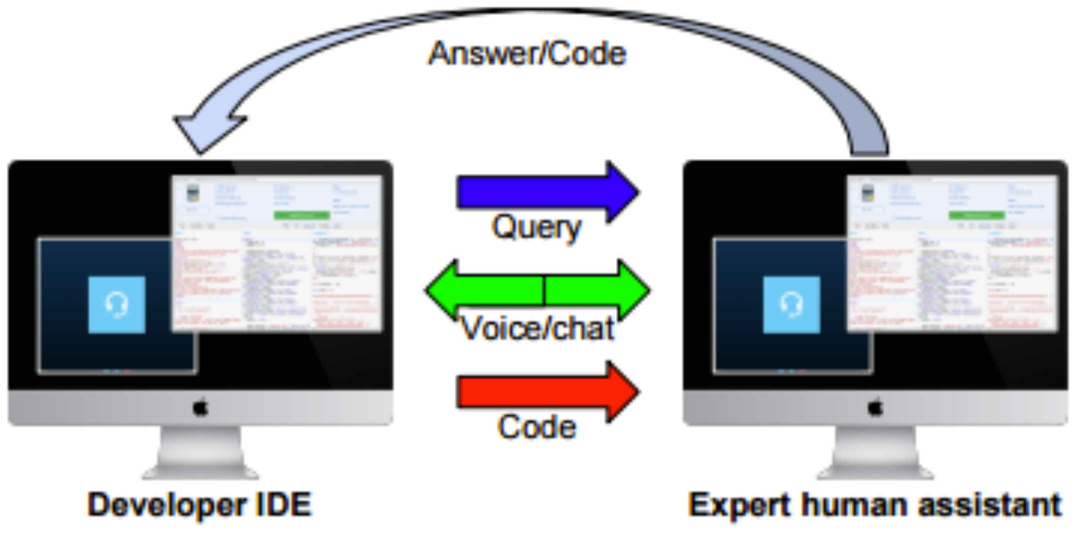


Figure 2. Setup for our human expert assistant study. In each trial, one "requester" participant (developer) was paired with one "helper" (expert, based on a pre-study skill assessment). Participants could chat via either text or voice, and requesters were able to share their screen with helpers as needed using Skype. The helper was tasked with assisting the requester *reactively*, meaning that they only responded to queries, and did not proactively propose solutions or approaches. This simulates a "best case" (repeated, non-multiplexed helper) on-demand model where human experts are not expected to be continuously available between end-user queries.

Patterns	Description	# Sessions (out of 12)	# / Session	# Interviews (out of 12)	# / Interview
Background	Helpers wanted to know the requester's experience level and background	11	1.5	7	0.7
Context	Helpers wanted to know what the high-level goals and context were	11	1.5	9	0.8
Sharing	Participants wanted a shared editor that lets helpers type code directly	11	2.1	11	1.1
Real-Time Response	Participants needed immediate responses (some preferred voice, others text)	12	N/A	10	0.9
Integrated System	Participants did not like switching windows, and would prefer a single system	9	N/A	7	0.8
Personalized Help	Requesters wanted help suited to their intent, e.g., specifying "teach me" when more explanation was desired	9	1.0	10	1.2

Y. Chen, S. Oney, **W.S. Lasecki**. (2016) Towards Providing On-Demand Expert Support for Software Developers. In *Proceedings of the ACM Conference on Human Factors in Computing Systems.*

HelpMeOut

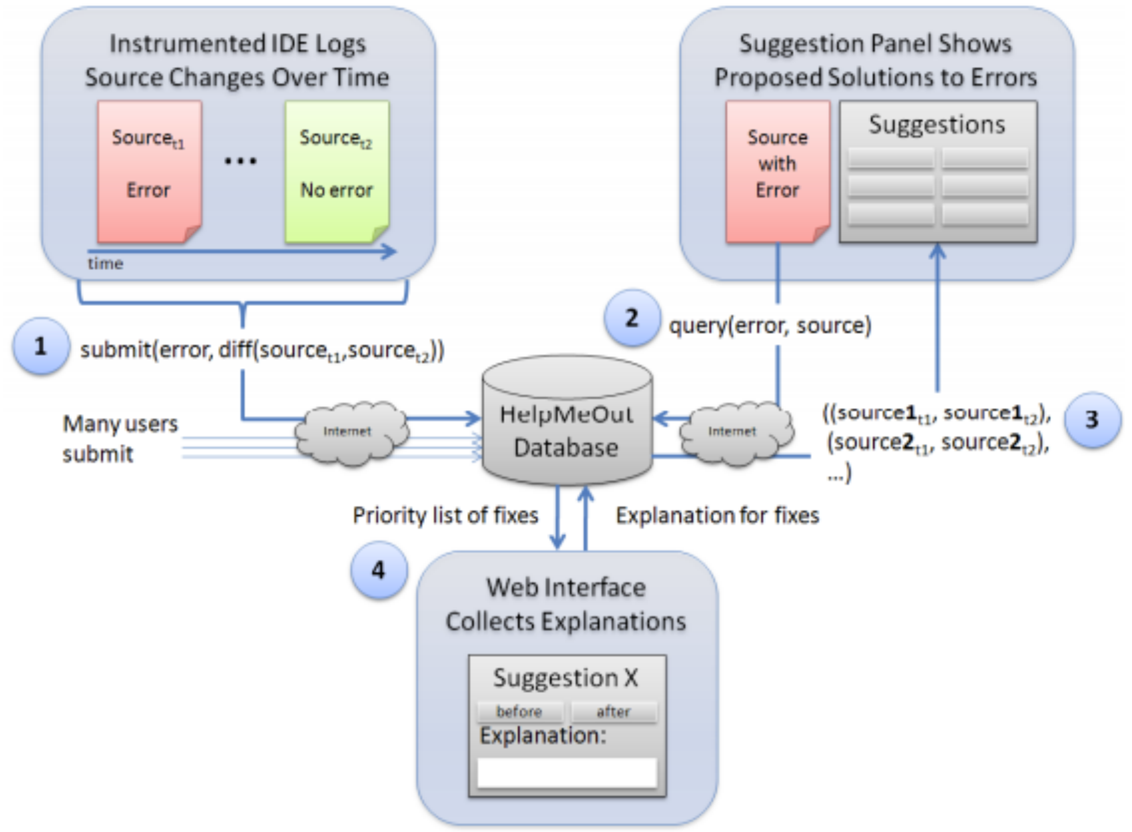
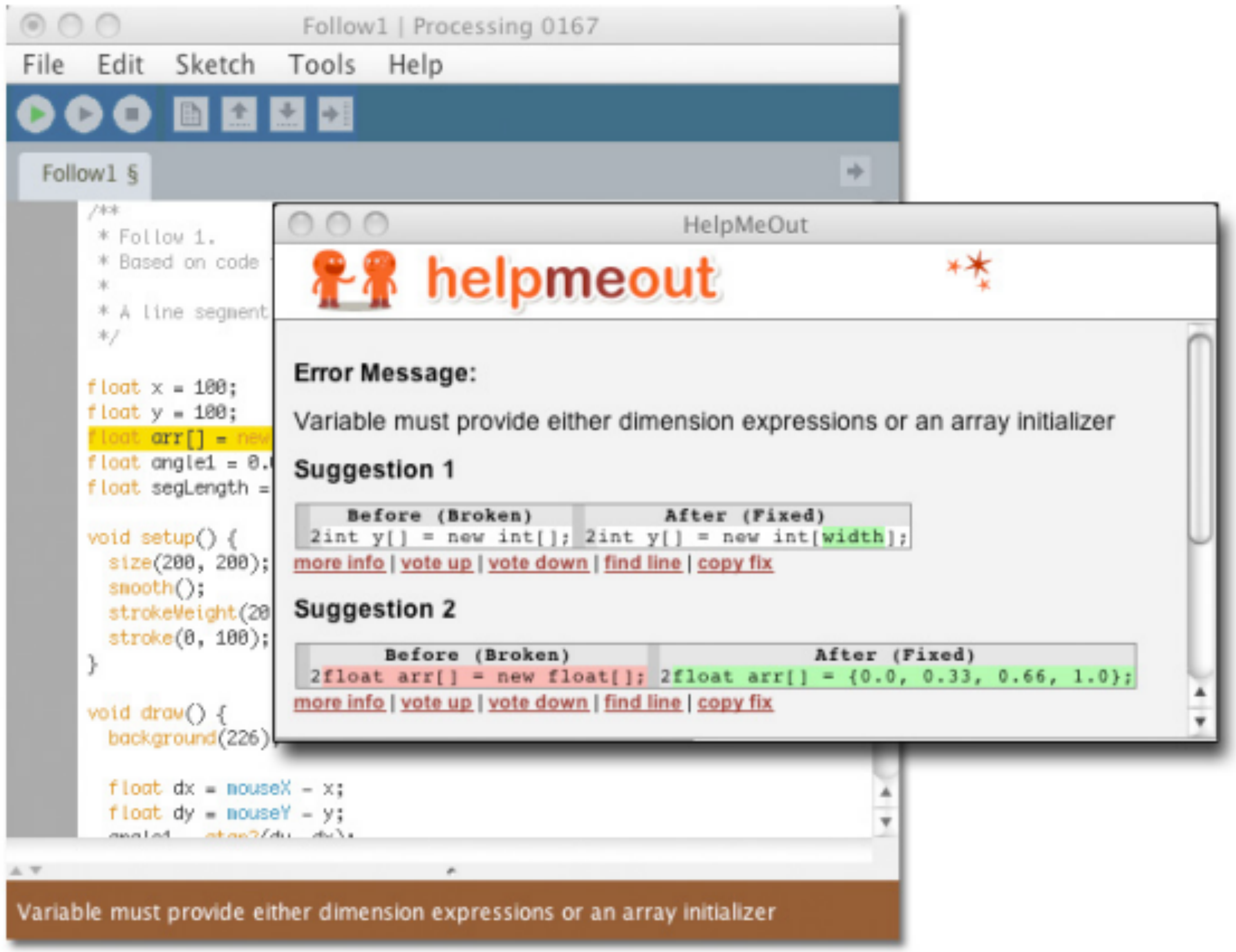

Instrumented IDE Logs Source Changes Over Time
Source$_{t1}$
Error
...
Source$_{t2}$
No error
time
1
submit(error, diff(source$_{t1}$,source$_{t2}$))
Many users submit
Internet
HelpMeOut Database
Internet
2
query(error, source)
Suggestion Panel Shows Proposed Solutions to Errors
Source with Error
Suggestions
3
((source1$_{t1}$, source1$_{t2}$), (source2$_{t1}$, source2$_{t2}$), ...)
Priority list of fixes
Explanation for fixes
4
Web Interface Collects Explanations
Suggestion X
before
after
Explanation:

Figure 1. HelpMeOut offers asynchronous collaboration to suggest corrections to programming errors. **1**: IDE instrumentation collects bug fixes and sends them to a remote database. **2**: Other programmers query the database when they encounter errors. **3**: Suggested fixes are shown inside their IDE. **4**: Explanations for fixes are collected in a web interface.



```
/**
 * Follow 1.
 * Based on code
 *
 * A line segment
 */

float x = 100;
float y = 100;
float arr[] = new
float angle1 = 0.
float segLength =

void setup() {
  size(200, 200);
  smooth();
  strokeWeight(20
  stroke(0, 100);
}

void draw() {
  background(226)

  float dx = mouseX - x;
  float dy = mouseY - y;
```

Error Message:

Variable must provide either dimension expressions or an array initializer

Suggestion 1

Before (Broken)	After (Fixed)
2int y[] = new int[];	2int y[] = new int[width];

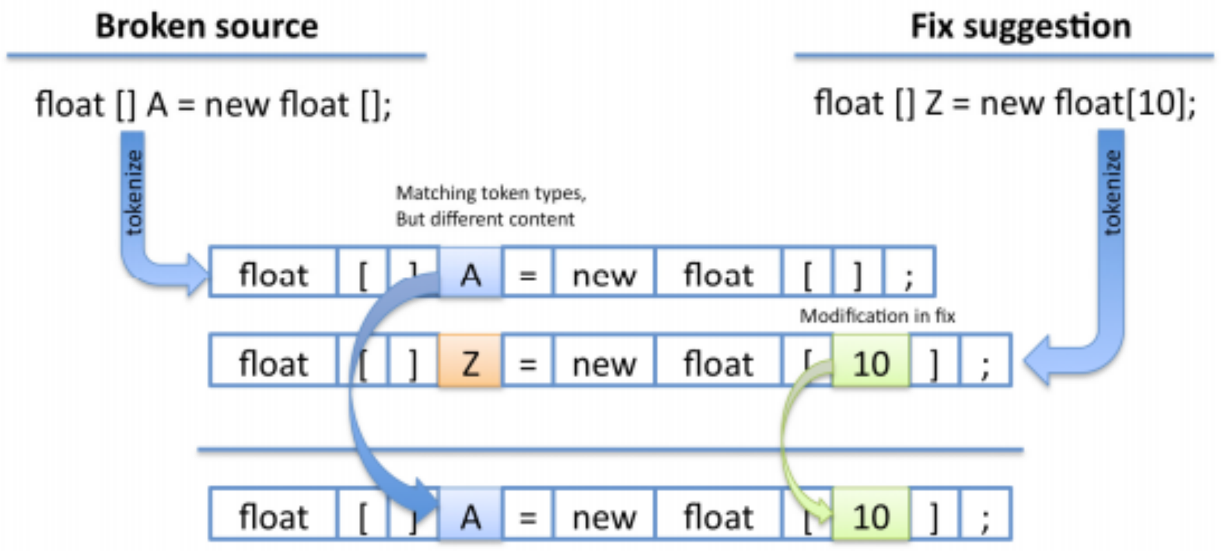
more info | vote up | vote down | find line | copy fix

Suggestion 2

Before (Broken)	After (Fixed)
2float arr[] = new float[];	2float arr[] = {0.0, 0.33, 0.66, 1.0};

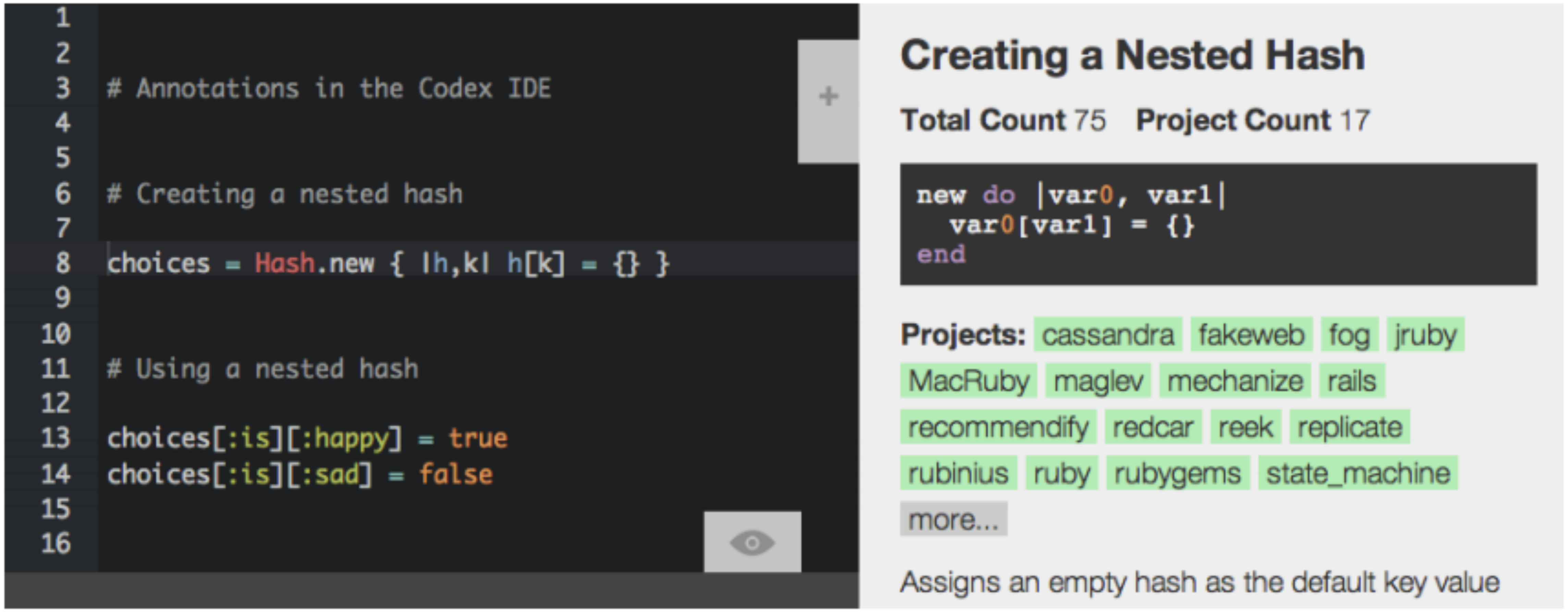
more info | vote up | vote down | find line | copy fix

Variable must provide either dimension expressions or an array initializer


Broken source
Fix suggestion
float [] A = new float [];
float [] Z = new float[10];
tokenize
tokenize
Matching token types, But different content
float [ ] A = new float [ ] ;
Modification in fix
float [ ] Z = new float [10] ;
float [ ] A = new float [10] ;

Björn Hartmann, Daniel MacDougall, Joel Brandt, and Scott R. Klemmer. 2010. What would other programmers do: suggesting solutions to error messages. *Conference on Human Factors in Computing Systems*, 1019-1028.

Codex



```
# Annotations in the Codex IDE

# Creating a nested hash

choices = Hash.new { |h,k| h[k] = {} }


# Using a nested hash

choices[:is][:happy] = true
choices[:is][:sad] = false
```

Creating a Nested Hash

Total Count 75 **Project Count** 17

```
new do |var0, var1|
  var0[var1] = {}
end
```

Projects: cassandra fakeweb fog jruby MacRuby maglev mechanize rails recommendify redcar reek replicate rubinius ruby rubygems state_machine more...

Assigns an empty hash as the default key value

Figure 1. Codex draws on millions of lines of open source code to create software engineering interfaces that integrate emergent programming practice. Here, Codex's pattern annotation calls out popular idioms that appear in the user's code.

https://www.youtube.com/watch?v=jAIWXbygKuc

Ethan Fast, Daniel Steffee, Lucy Wang, Joel R. Brandt, and Michael S. Bernstein. 2014. Emergent, crowd-scale programming practice in the IDE. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems*, 2491-2500.

Increasing parallelism in programming

Build a large application in a day?

>24 million users x 1 day = ???

codecademy

Reduce joining barriers

- OSS imposes *joining barriers* that dissuade casual contributions
    - Identifying appropriate contacts & receiving timely feedback
    - Identifying appropriate tasks and corresponding artifacts
    - Understanding project structure, complex code, setting up a workplace
    - Unclear documentation & info overload
    - Learning project practices, domain knowledge, technical expertise

I. Steinmacher, M. A. G. Silva, M. A. Gerosa, and D. F. Redmiles, "A systematic literature review on the barriers faced by newcomers to open source software projects," *Inf. Softw. Technol.*, vol. 59, pp. 67–85, 2015.

Costs & challenges

- Task context & interdependence

- Handoffs — Specification often implicit through interpretation of requirements & domain, rather than explicitly represented in artifacts.

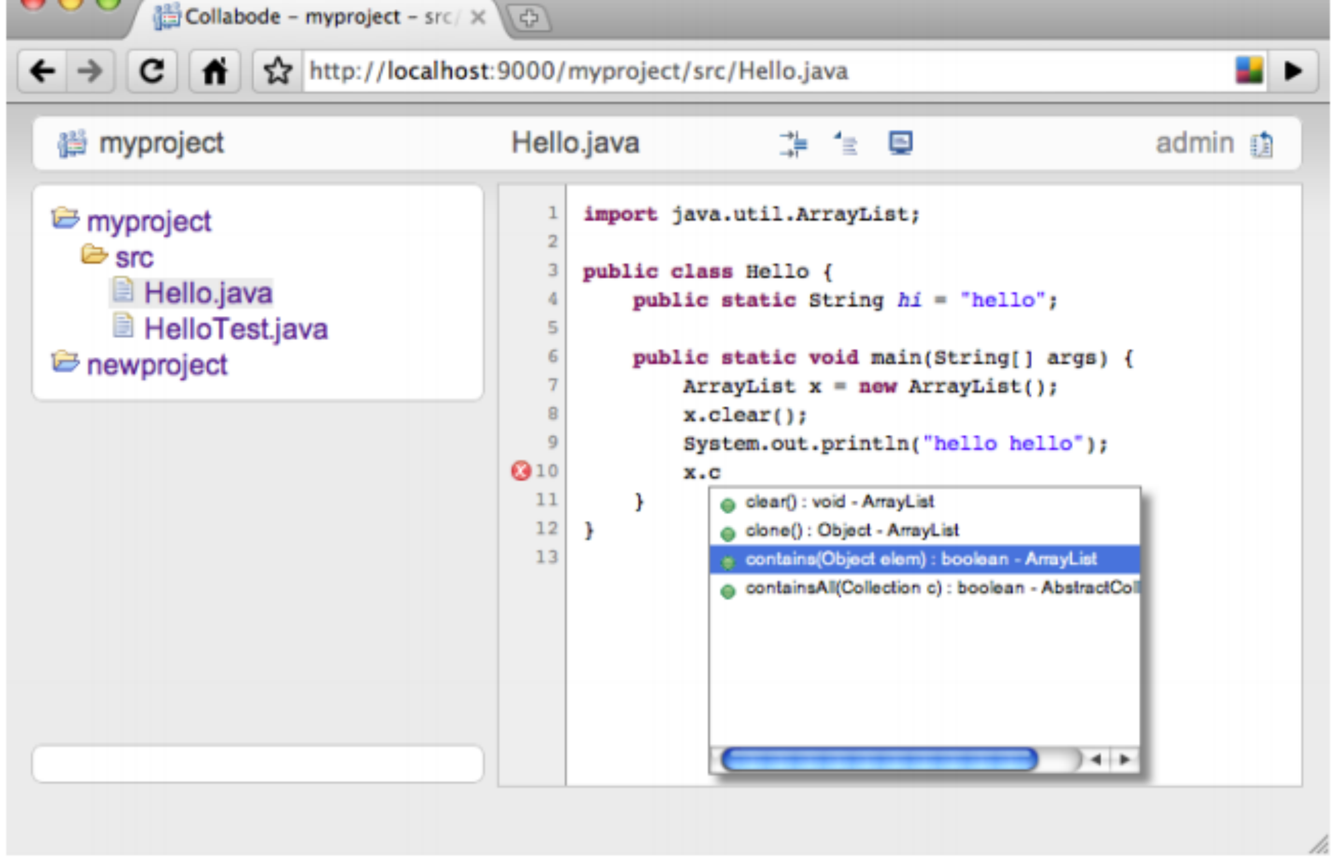
Key questions

To what extent can software development work be decomposed at a granularity smaller than commits?

What task context would such tasks require?

How could such work be coordinated and organized?

Collabode


Collabode – myproject – src
http://localhost:9000/myproject/src/Hello.java
myproject
Hello.java
admin
myproject
src
Hello.java
HelloTest.java
newproject
clear() : void - ArrayList
clone() : Object - ArrayList
contains(Object elem) : boolean - ArrayList
containsAll(Collection c) : boolean - AbstractColl

```
import java.util.ArrayList;

public class Hello {
    public static String hi = "hello";

    public static void main(String[] args) {
        ArrayList x = new ArrayList();
        x.clear();
        System.out.println("hello hello");
        x.c
    }
}
```

Figure 1: The Collabode web-based IDE allows multiple simultaneous editors to work together.

- Micro-outsourcing
  - Enables “original programmer” to describe custom microtasks in prose
  - Each microtask completed by workers
  - Workers may discuss microtasks with original programmer for clarification
  - Original programmer responsible for feedback

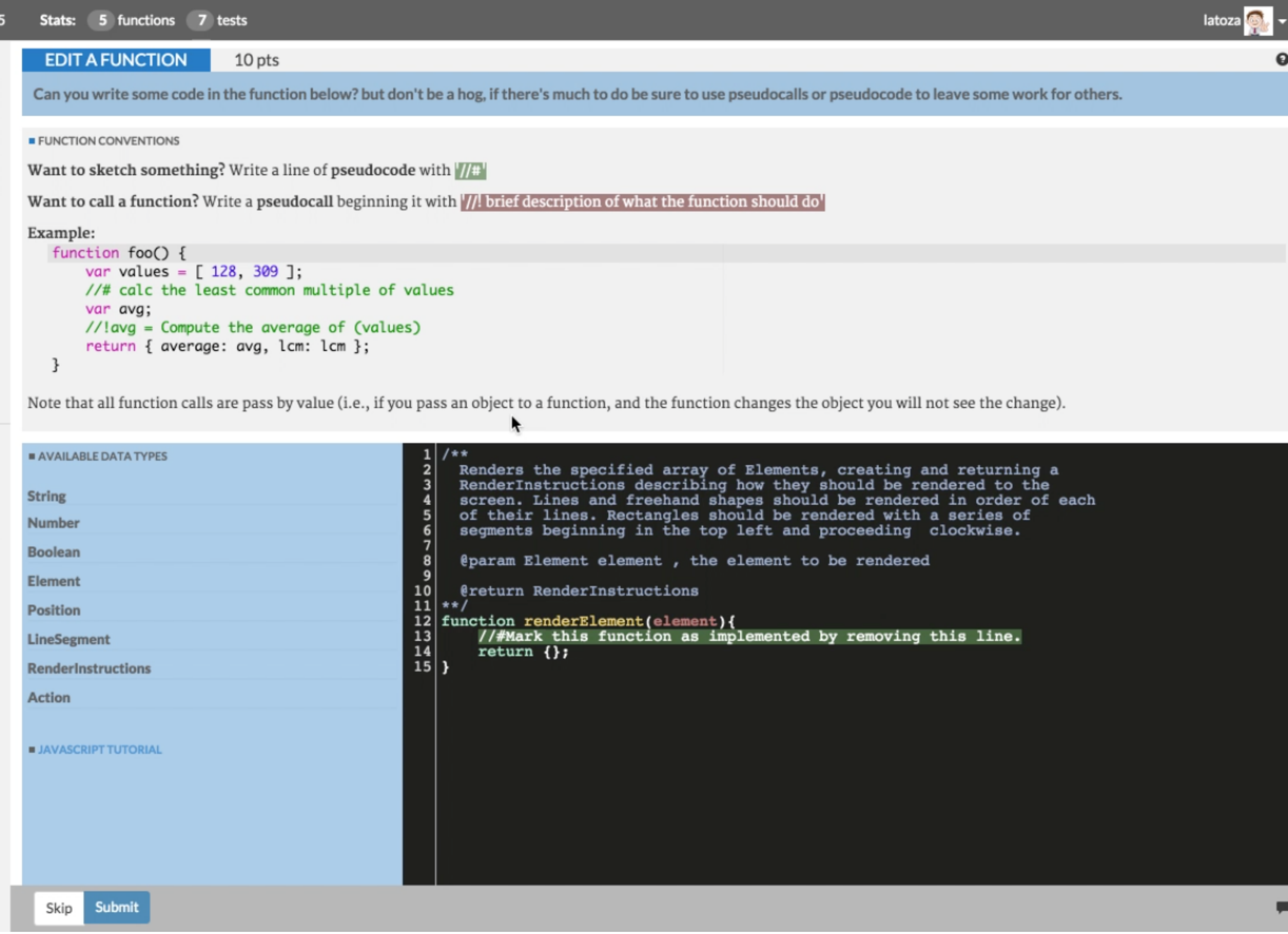
Max Goldman, Greg Little, and Robert C. Miller. Real-Time Collaborative Coding in a Web IDE. UIST '11.
Max Goldman, Greg Little, and Robert C. Miller. Collabode: Collaborative Coding in the Browser. CHASE '11.

Collabode Evaluation

- Was possible to use the workflow for programming
- But…
    - Managing the crowd imposed large overhead on requestor to answer questions & eval contributions
    - Code often had subtle bugs, which were time consuming to find and identify
    - Anonymous workers led to low responsibility for work

Microtask programming model

- Programming tasks
  - are short (< 10 minutes)
  - are completed by pool of transient workers
  - are automatically generated by system
  - iteratively update artifacts



Stats: 5 functions 7 tests

latoza

EDIT A FUNCTION 10 pts

Can you write some code in the function below? but don't be a hog, if there's much to do be sure to use pseudocalls or pseudocode to leave some work for others.

FUNCTION CONVENTIONS

Want to sketch something? Write a line of **pseudocode** with '//#'

Want to call a function? Write a **pseudocall** beginning it with '//! brief description of what the function should do'

Example:

```
function foo() {
    var values = [ 128, 309 ];
    //# calc the least common multiple of values
    var avg;
    //!avg = Compute the average of (values)
    return { average: avg, lcm: lcm };
}
```

Note that all function calls are pass by value (i.e., if you pass an object to a function, and the function changes the object you will not see the change).

AVAILABLE DATA TYPES

- String
- Number
- Boolean
- Element
- Position
- LineSegment
- RenderInstructions
- Action

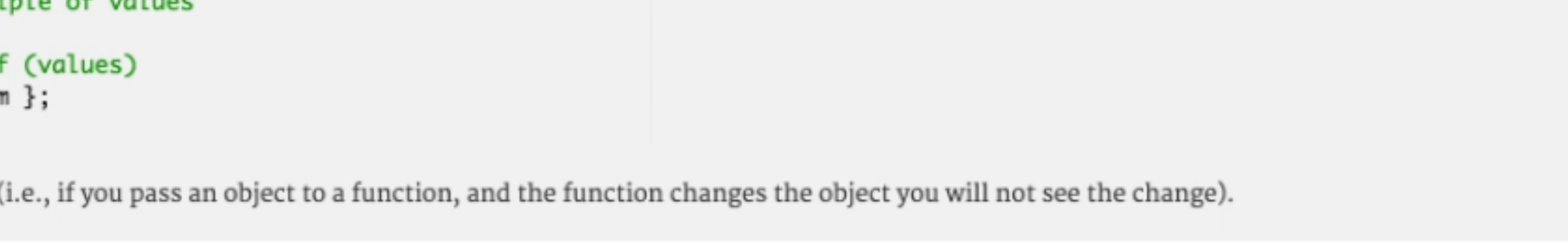
JAVASCRIPT TUTORIAL

```
/**
  Renders the specified array of Elements, creating and returning a
  RenderInstructions describing how they should be rendered to the
  screen. Lines and freehand shapes should be rendered in order of each
  of their lines. Rectangles should be rendered with a series of
  segments beginning in the top left and proceeding  clockwise.

  @param Element element , the element to be rendered

  @return RenderInstructions
**/
function renderElement(element){
    //#Mark this function as implemented by removing this line.
    return {};
}
```

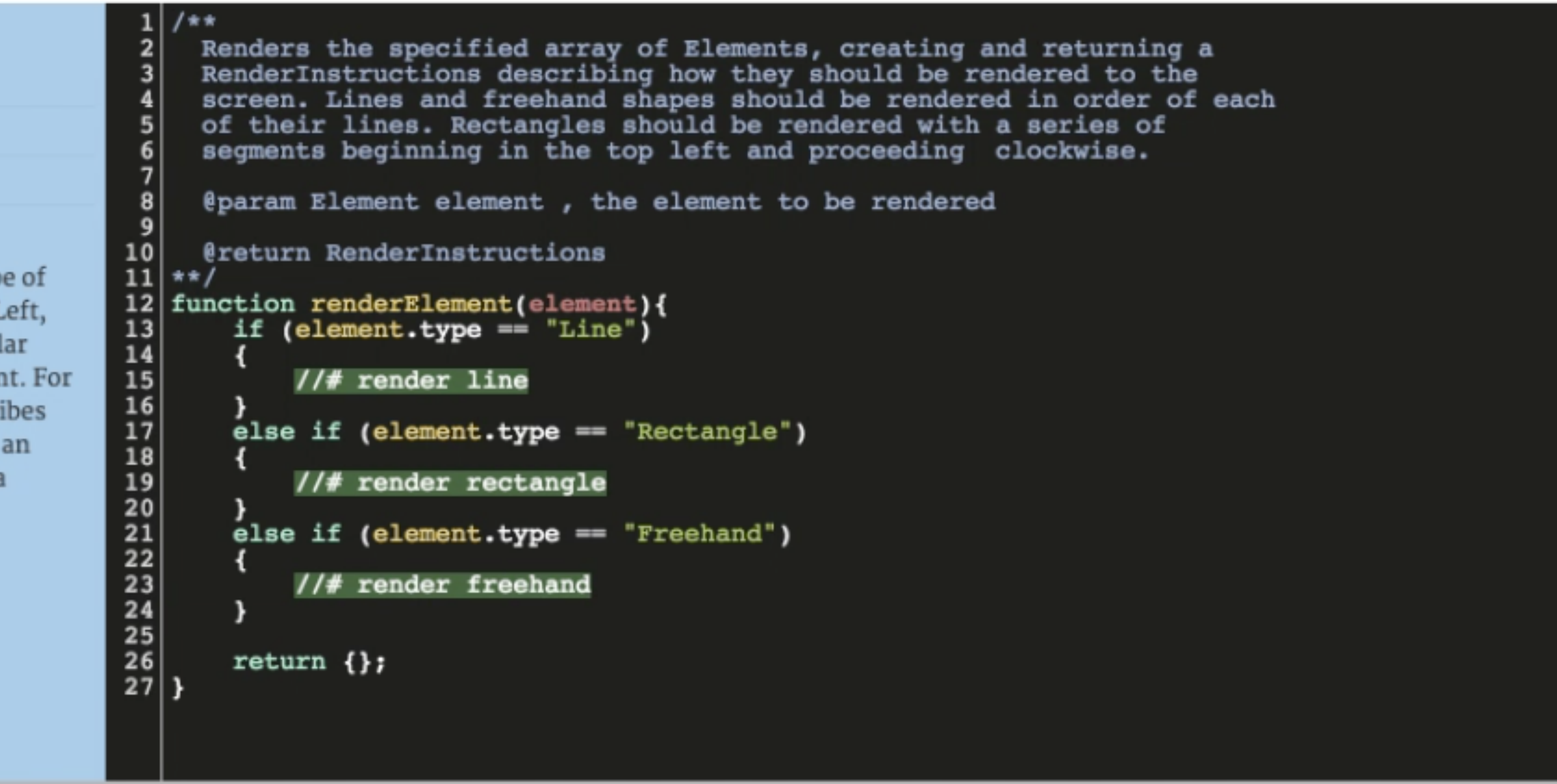
Skip Submit



```
iple of values

f (values)
m };
```

(i.e., if you pass an object to a function, and the function changes the object you will not see the change).



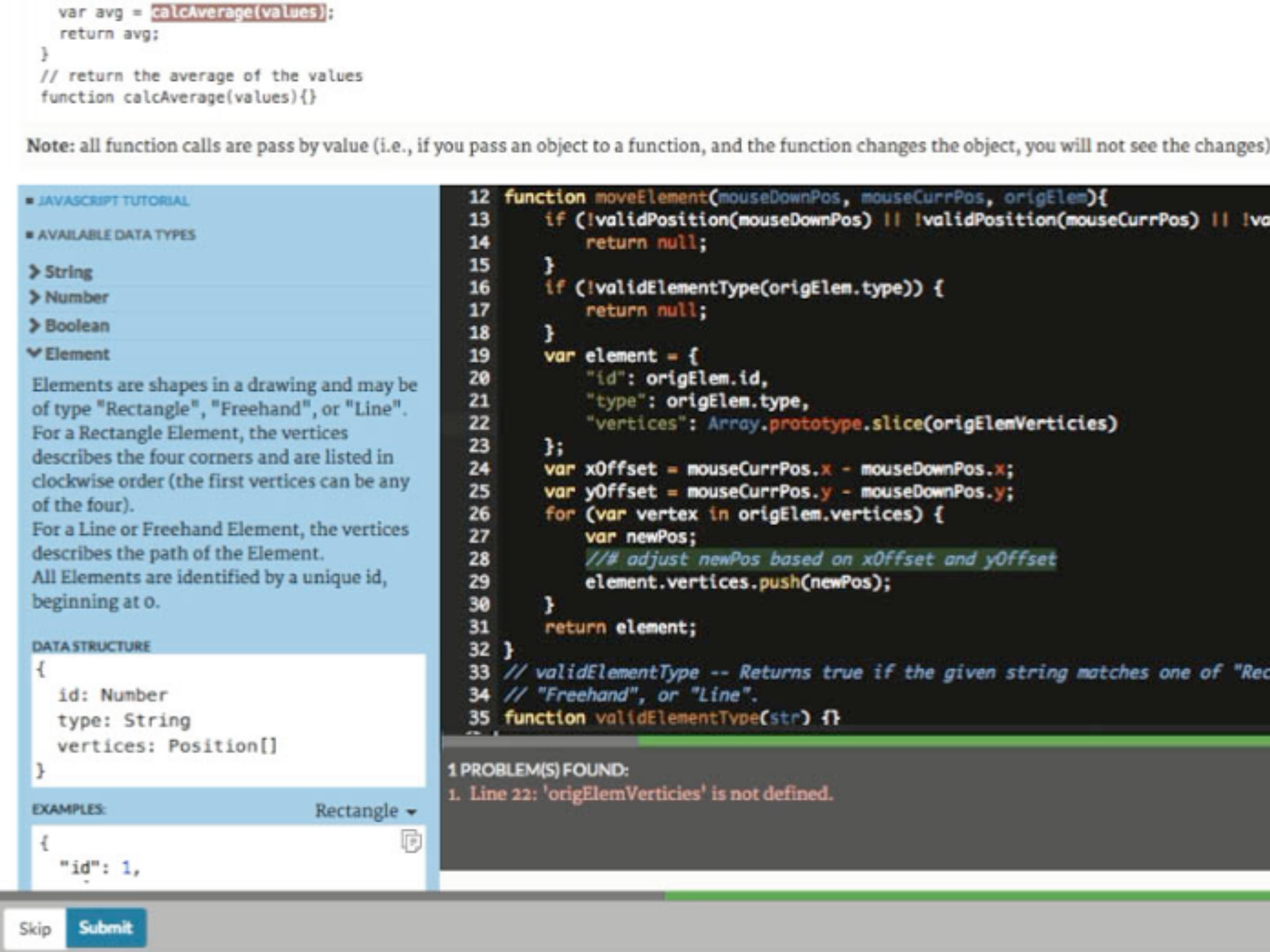
e of
Left,
lar
nt. For
ibes
an
a

```
/**
  Renders the specified array of Elements, creating and returning a
  RenderInstructions describing how they should be rendered to the
  screen. Lines and freehand shapes should be rendered in order of each
  of their lines. Rectangles should be rendered with a series of
  segments beginning in the top left and proceeding  clockwise.

  @param Element element , the element to be rendered

  @return RenderInstructions
**/
function renderElement(element){
    if (element.type == "Line")
    {
        //# render line
    }
    else if (element.type == "Rectangle")
    {
        //# render rectangle
    }
    else if (element.type == "Freehand")
    {
        //# render freehand
    }

    return {};
}
```



```
    var avg = calcAverage(values);
    return avg;
  }
  // return the average of the values
  function calcAverage(values){}
```

Note: all function calls are pass by value (i.e., if you pass an object to a function, and the function changes the object, you will not see the changes)

Elements are shapes in a drawing and may be of type "Rectangle", "Freehand", or "Line".
For a Rectangle Element, the vertices describes the four corners and are listed in clockwise order (the first vertices can be any of the four).
For a Line or Freehand Element, the vertices describes the path of the Element.
All Elements are identified by a unique id, beginning at 0.

DATA STRUCTURE

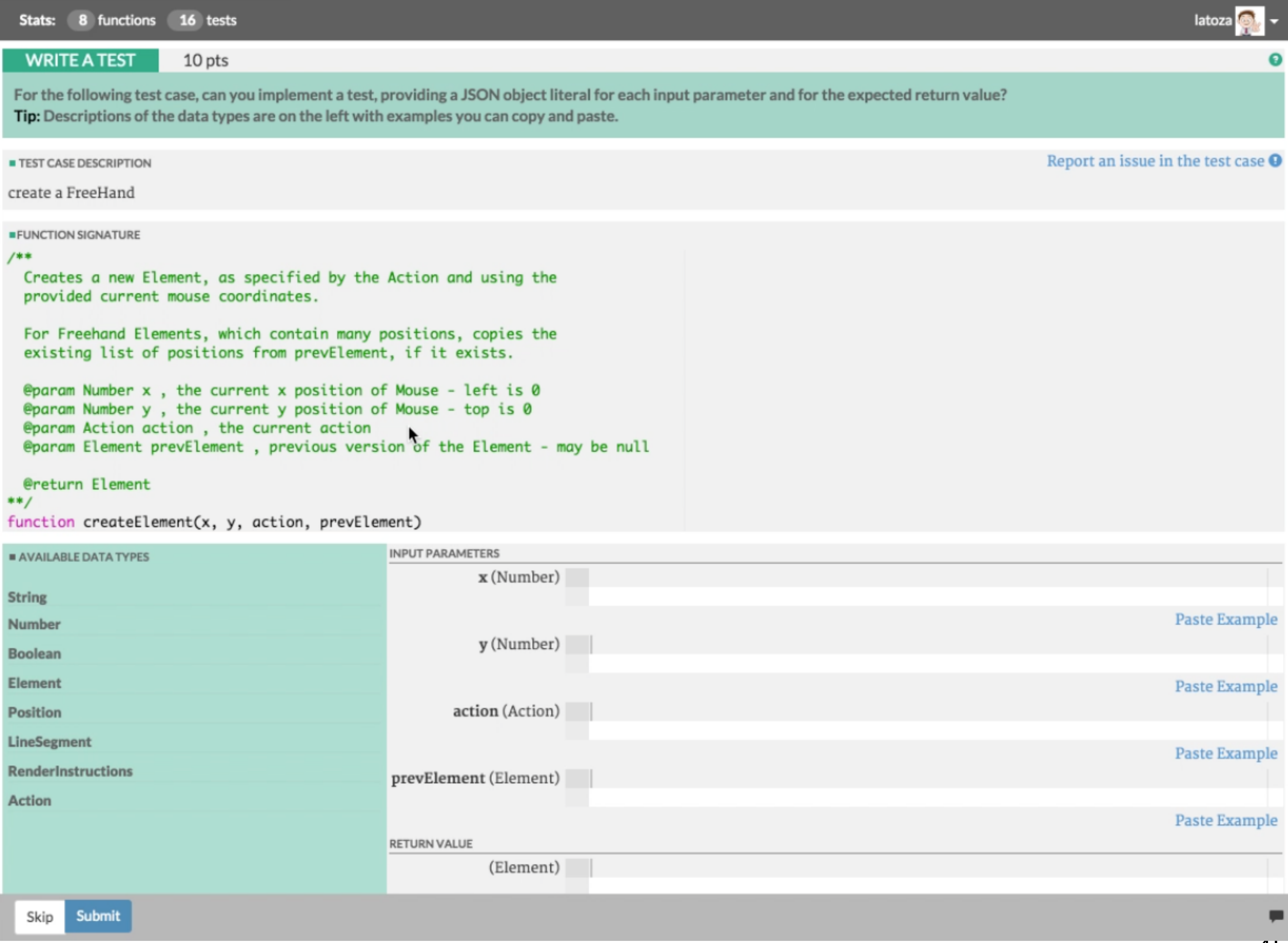
```
{
  id: Number
  type: String
  vertices: Position[]
}
```

EXAMPLES: Rectangle ▾

```
{
  "id": 1,
```

```
12 function moveElement(mouseDownPos, mouseCurrPos, origElem){
13     if (!validPosition(mouseDownPos) || !validPosition(mouseCurrPos) || !va
14         return null;
15     }
16     if (!validElementType(origElem.type)) {
17         return null;
18     }
19     var element = {
20         "id": origElem.id,
21         "type": origElem.type,
22         "vertices": Array.prototype.slice(origElemVerticies)
23     };
24     var xOffset = mouseCurrPos.x - mouseDownPos.x;
25     var yOffset = mouseCurrPos.y - mouseDownPos.y;
26     for (var vertex in origElem.vertices) {
27         var newPos;
28         //# adjust newPos based on xOffset and yOffset
29         element.vertices.push(newPos);
30     }
31     return element;
32 }
33 // validElementType -- Returns true if the given string matches one of "Rec
34 // "Freehand", or "Line".
35 function validElementType(str) {}
```

```
1 PROBLEM(S) FOUND:
1. Line 22: 'origElemVerticies' is not defined.
```



Stats: 8 functions 16 tests latoza

WRITE A TEST 10 pts

For the following test case, can you implement a test, providing a JSON object literal for each input parameter and for the expected return value?
Tip: Descriptions of the data types are on the left with examples you can copy and paste.

TEST CASE DESCRIPTION

Report an issue in the test case

create a FreeHand

FUNCTION SIGNATURE

```
/**
  Creates a new Element, as specified by the Action and using the
  provided current mouse coordinates.

  For Freehand Elements, which contain many positions, copies the
  existing list of positions from prevElement, if it exists.

  @param Number x , the current x position of Mouse - left is 0
  @param Number y , the current y position of Mouse - top is 0
  @param Action action , the current action
  @param Element prevElement , previous version of the Element - may be null

  @return Element
**/
function createElement(x, y, action, prevElement)
```

AVAILABLE DATA TYPES

String
Number
Boolean
Element
Position
LineSegment
RenderInstructions
Action

INPUT PARAMETERS

x (Number)

Paste Example

y (Number)

Paste Example

action (Action)

Paste Example

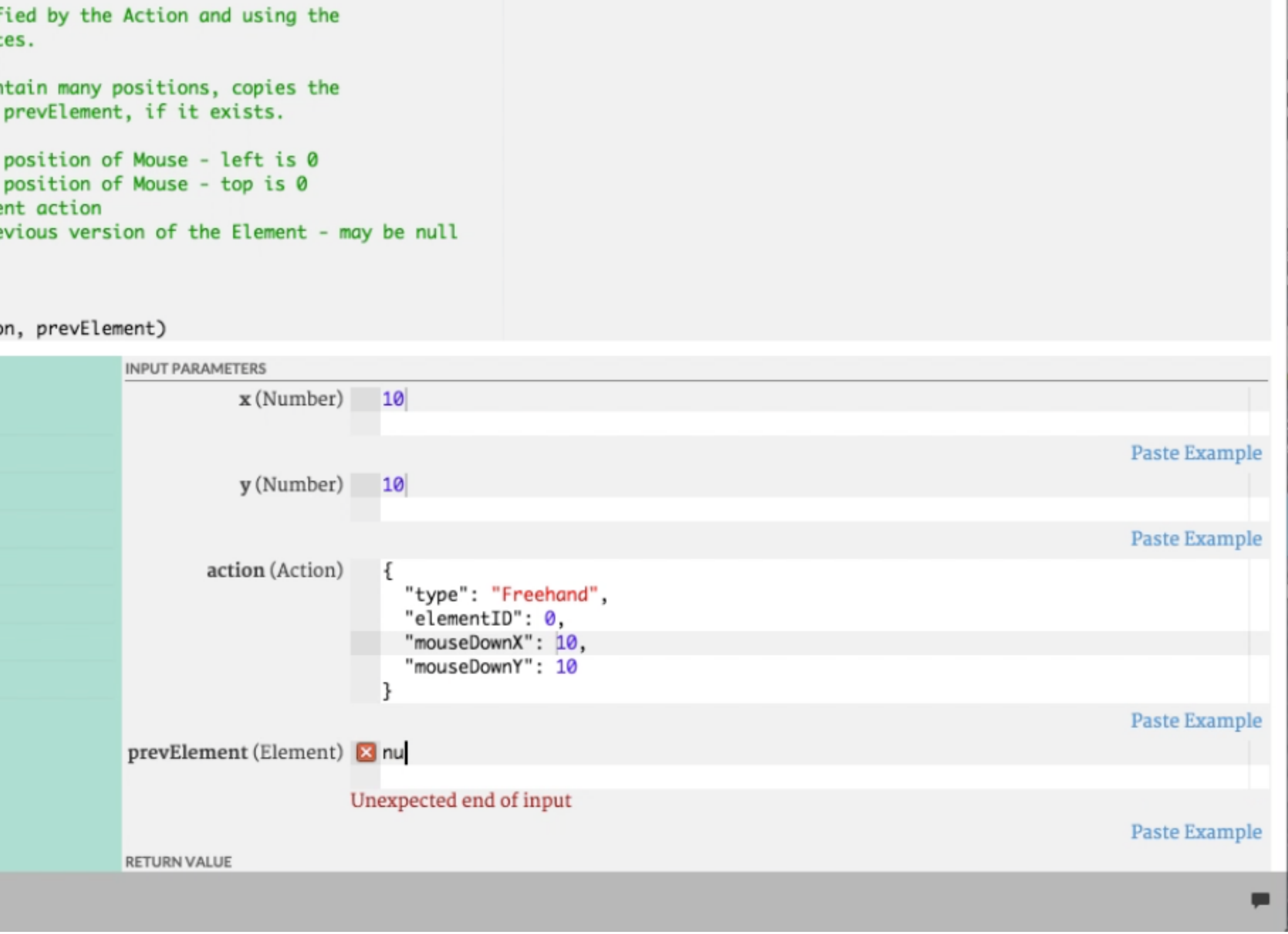
prevElement (Element)

Paste Example

RETURN VALUE

(Element)

Skip Submit



```
ied by the Action and using the
es.

tain many positions, copies the
 prevElement, if it exists.

 position of Mouse - left is 0
 position of Mouse - top is 0
nt action
vious version of the Element - may be null



n, prevElement)
```

INPUT PARAMETERS

x (Number)
```
10
```
Paste Example

y (Number)
```
10
```
Paste Example

action (Action)
```
{
  "type": "Freehand",
  "elementID": 0,
  "mouseDownX": 10,
  "mouseDownY": 10
}
```
Paste Example

prevElement (Element)
```
nu
```
Unexpected end of input

Paste Example

RETURN VALUE

Enabling fine-grained contributions

Local changes to a single function or test

  Type system, request functionality through pseudocalls

Preconfigured environment

Tutorial system introducing microtasks

Encourage mass **parallelism**

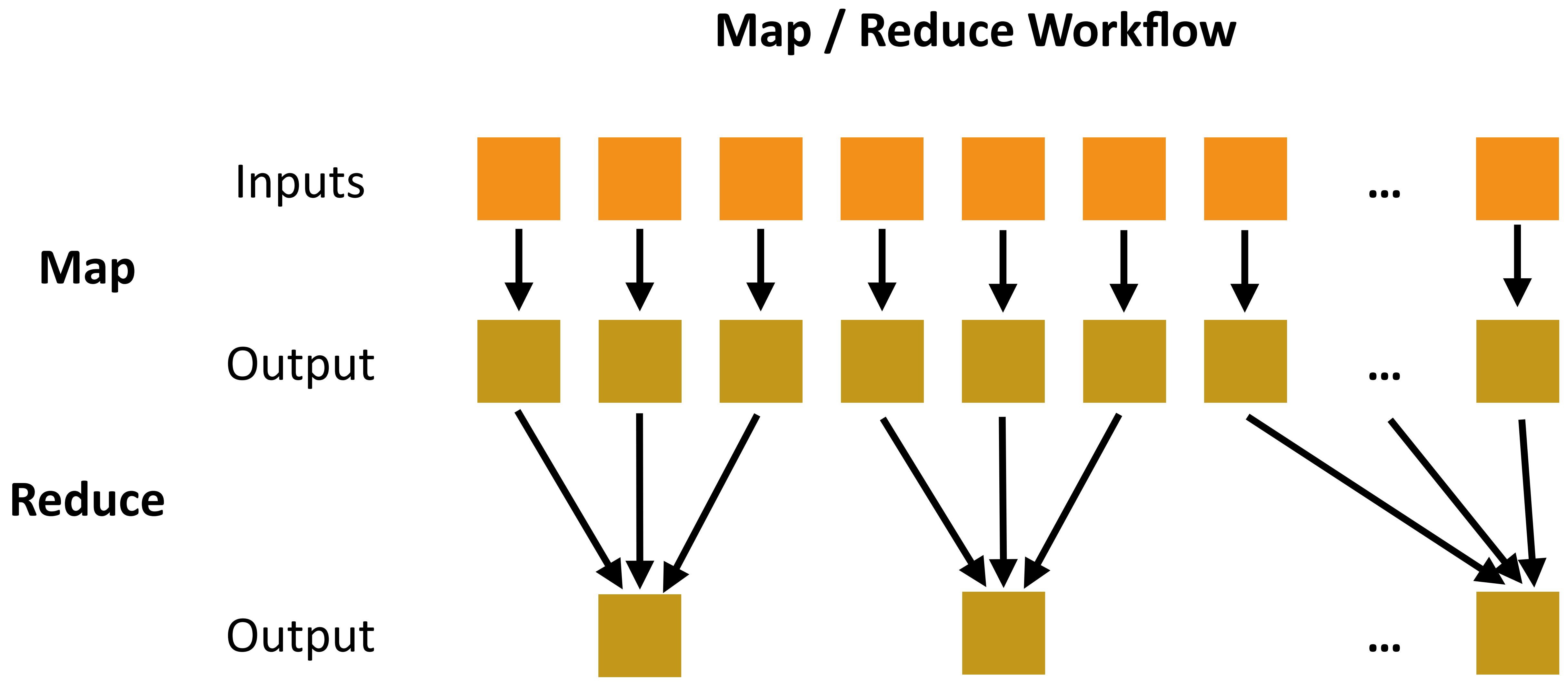
  Collective ownership of code

  Time & space box contributions

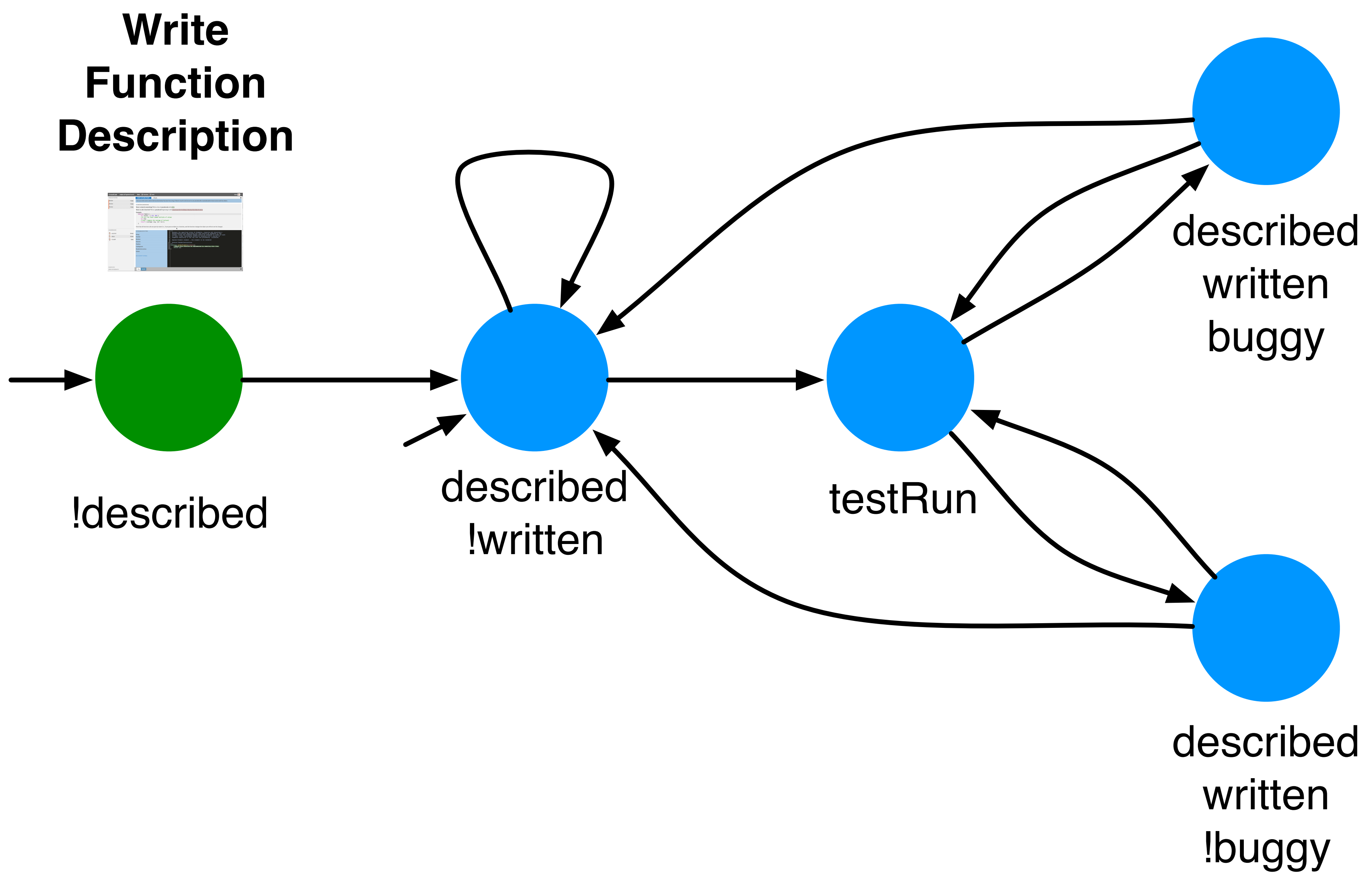
Automatic microtask generation

Existing microtask workflows enumerate microtasks statically (e.g., map-reduce)

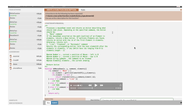
Programming work cannot be statically enumerated upfront.
— Work created in response to work completed.

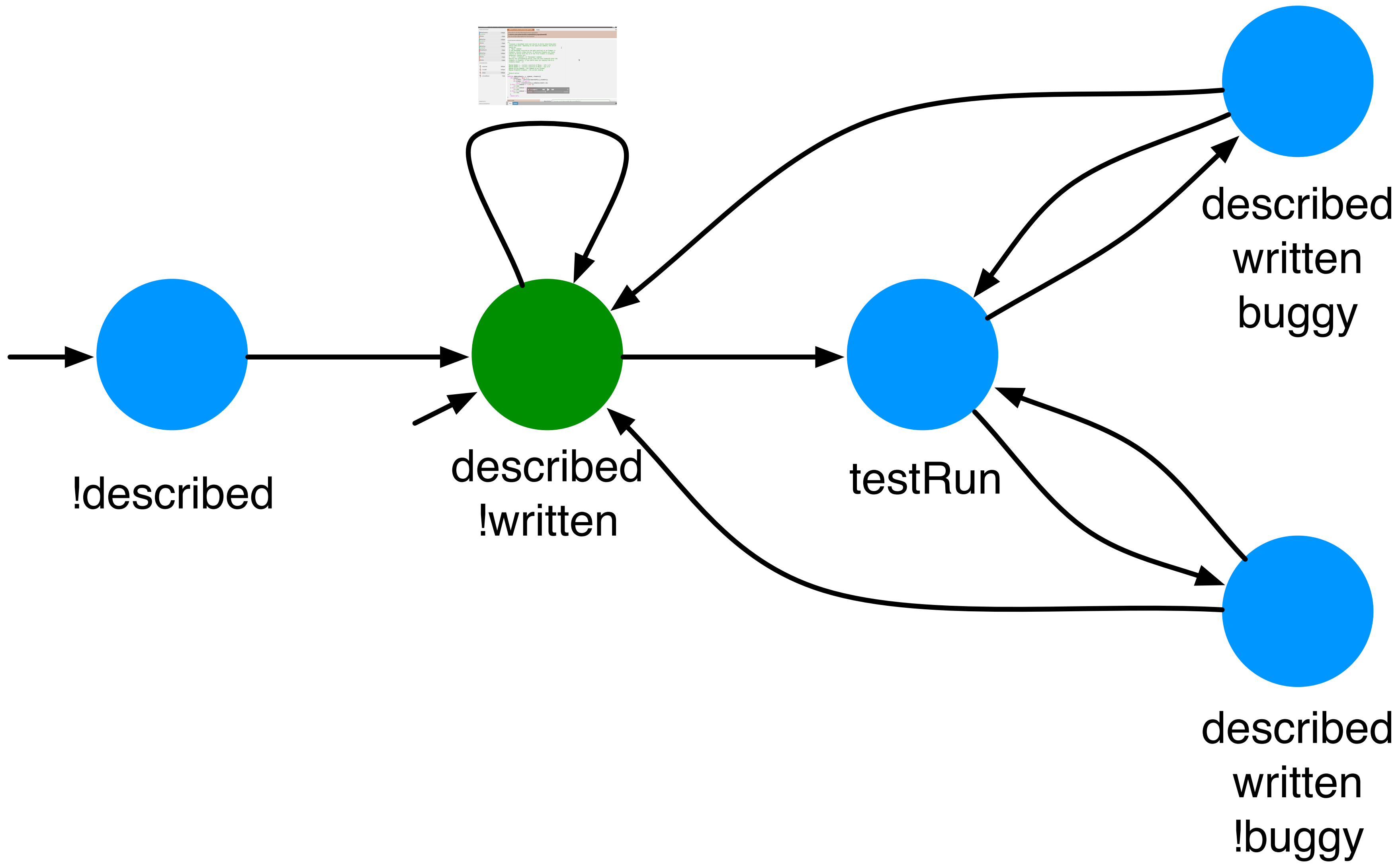


Function state machine - example

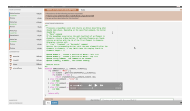


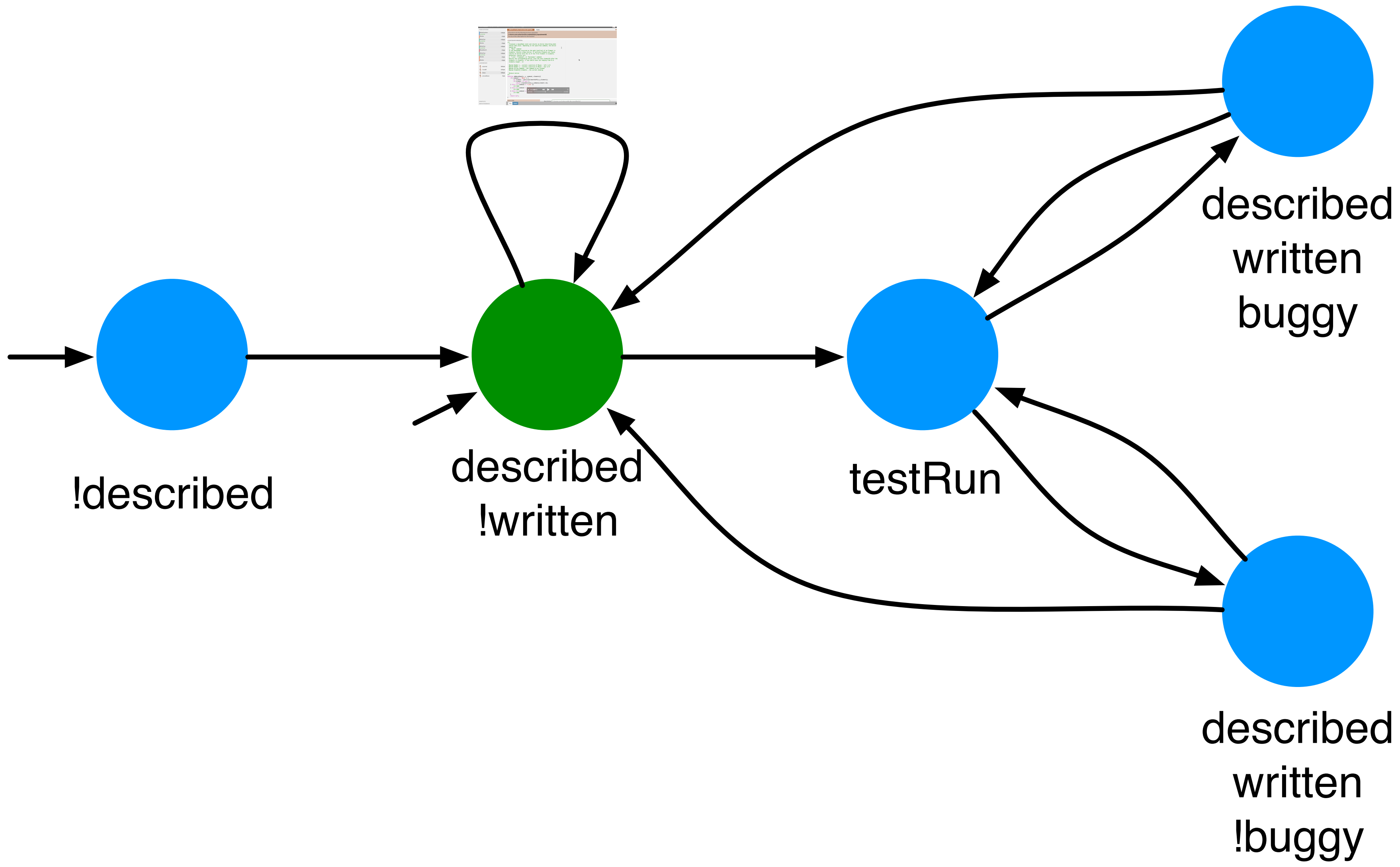
Edit a Function

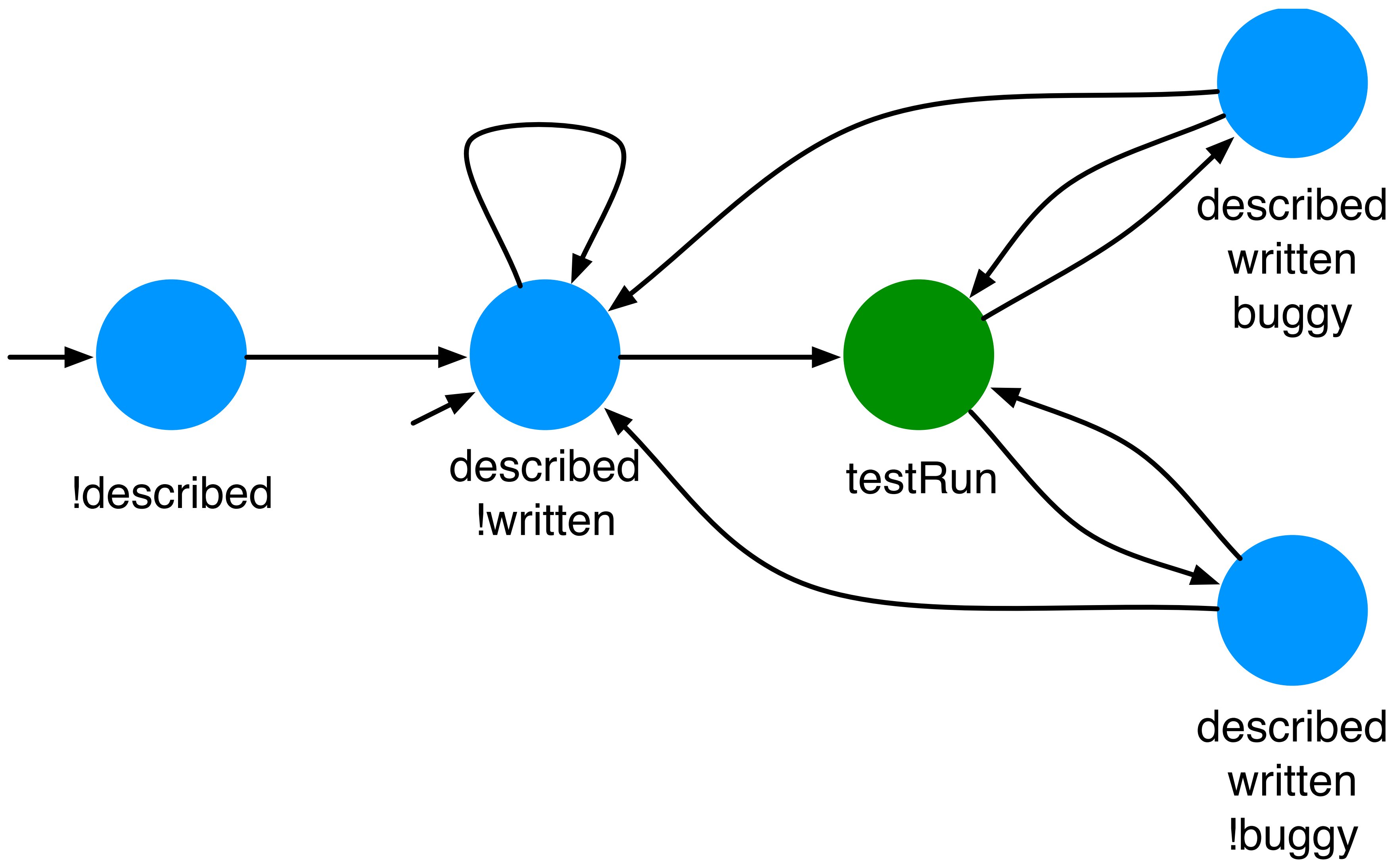




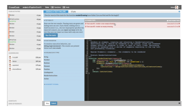
Edit a Function

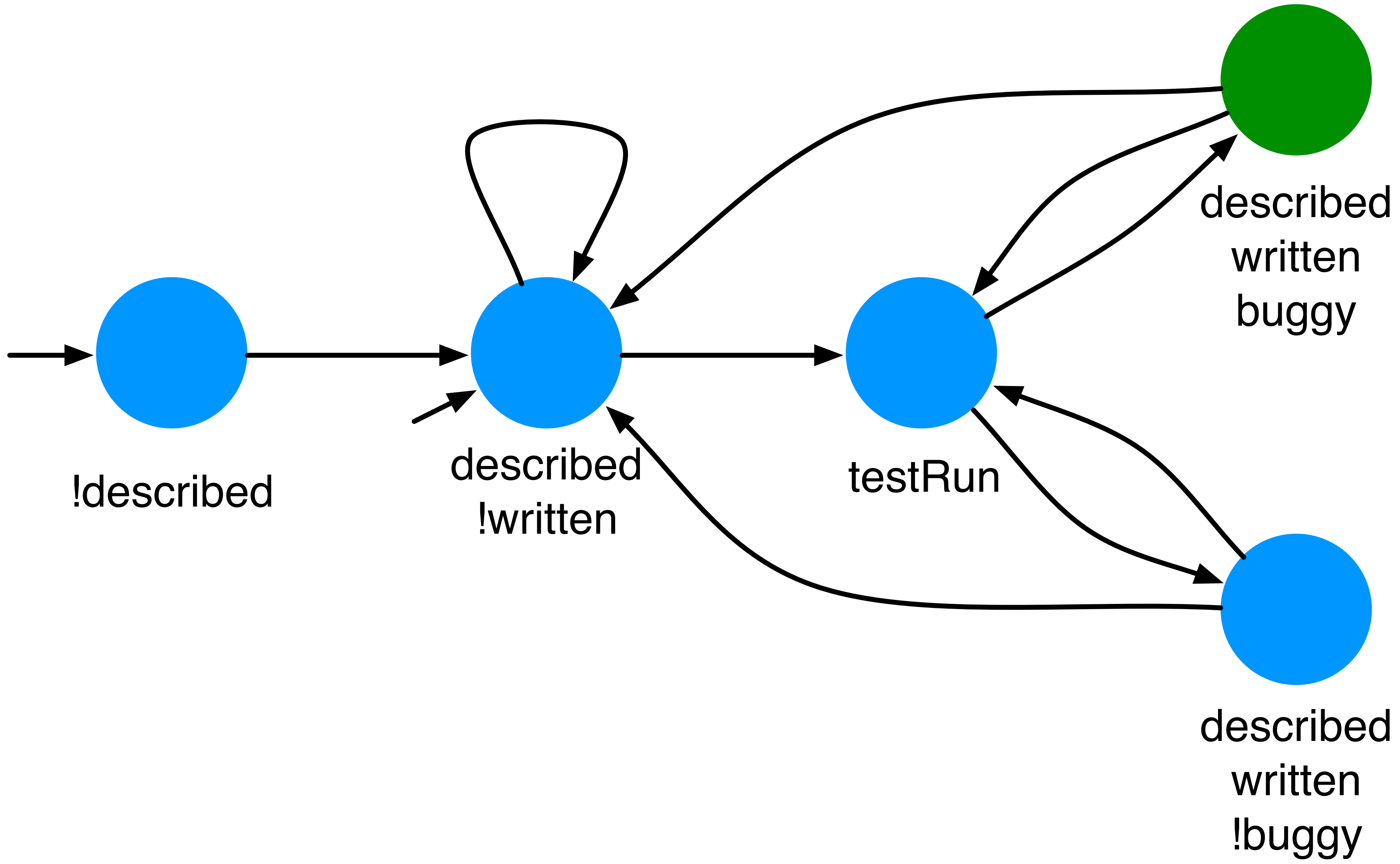




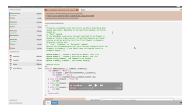

!described
described
!written
testRun
described
written
buggy
described
written
!buggy

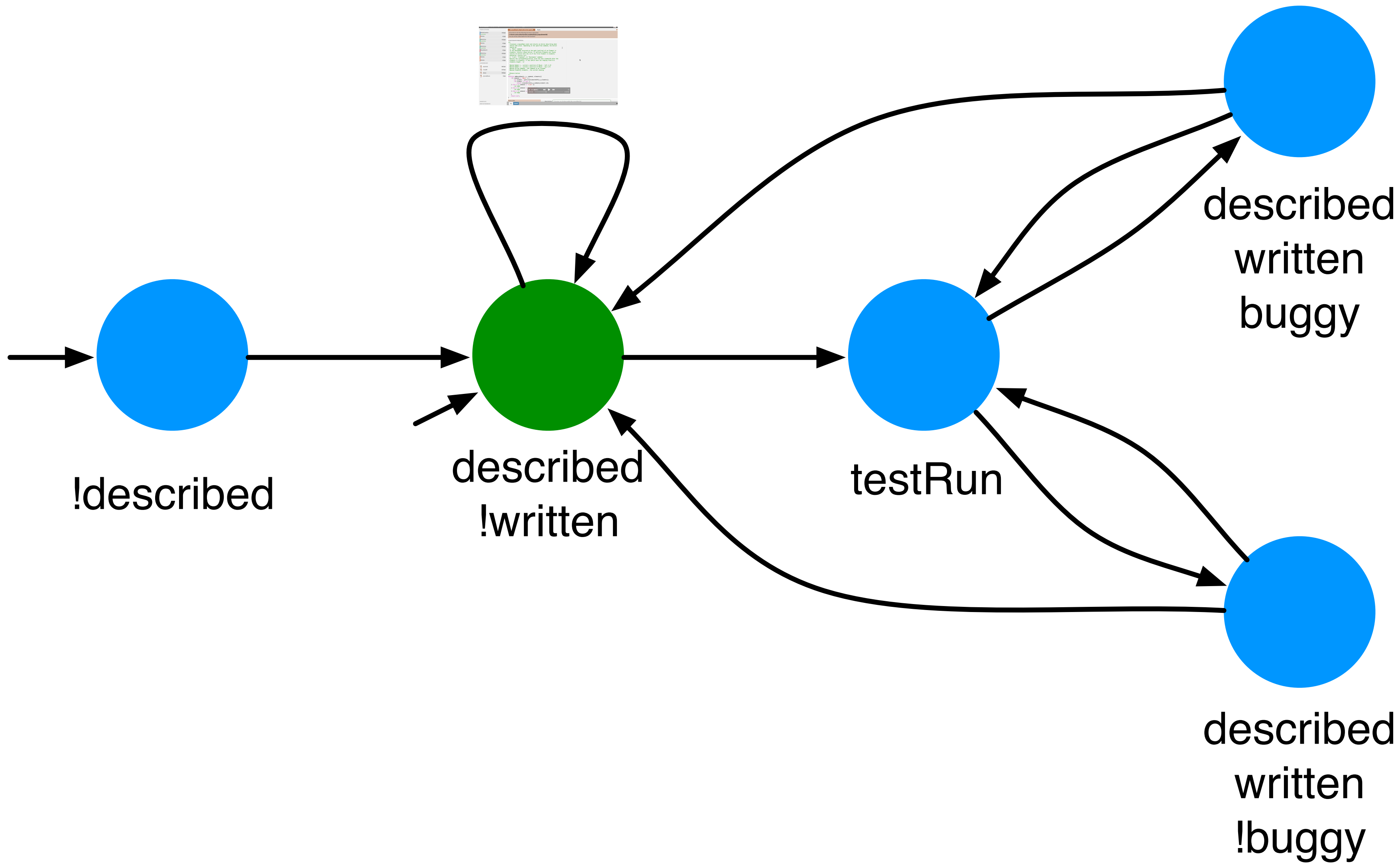
Debug
a Test Failure

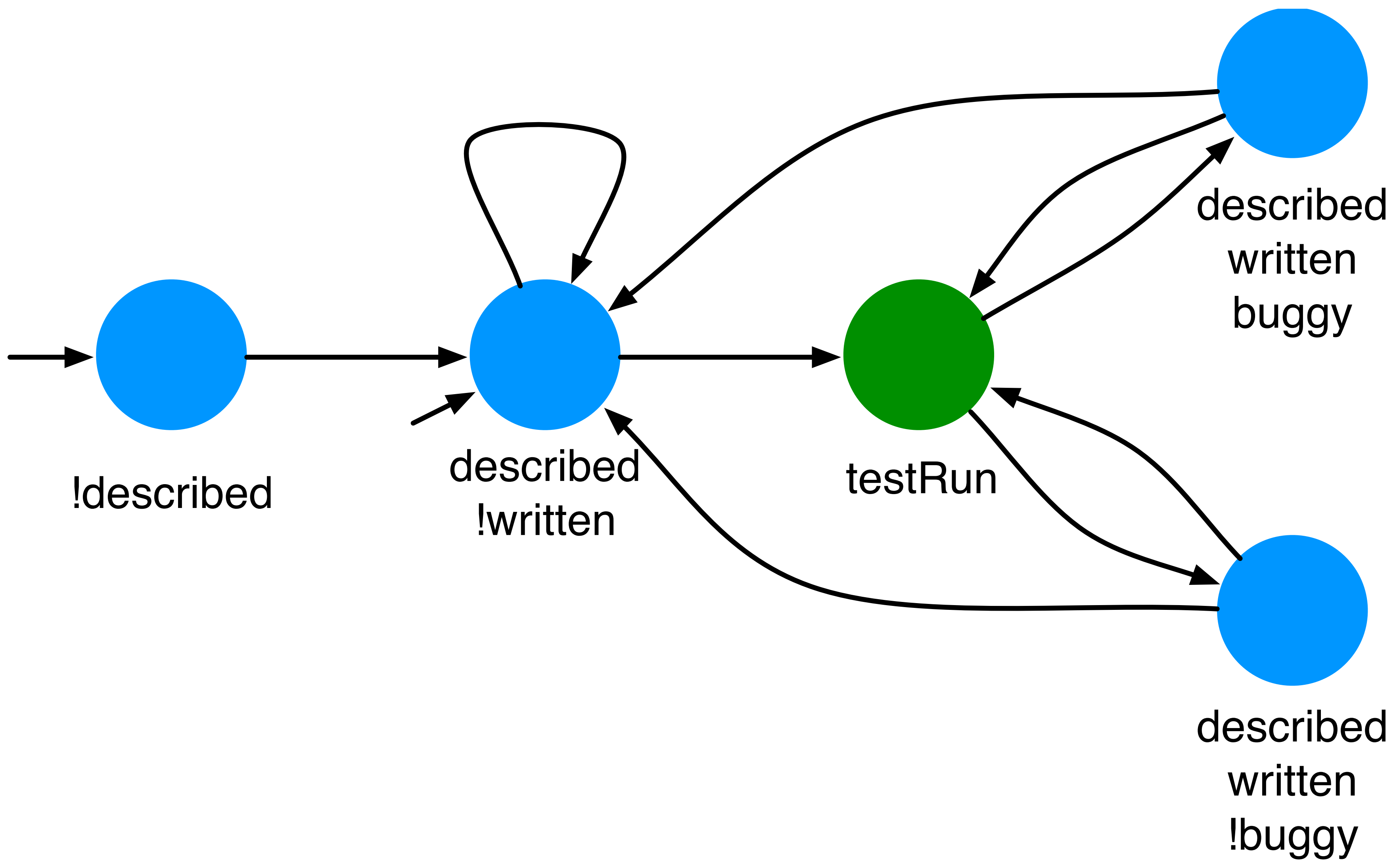


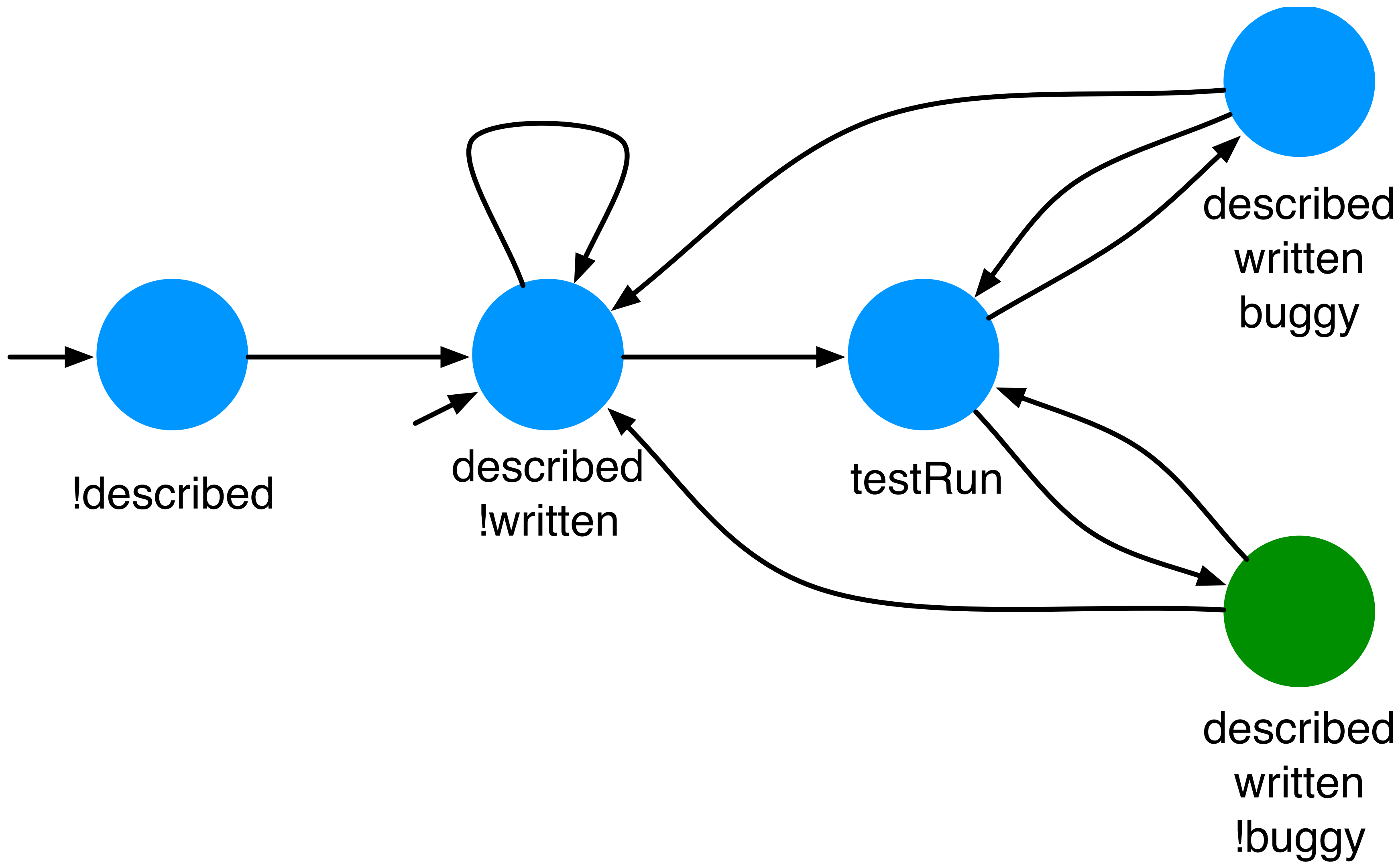


Edit a Function

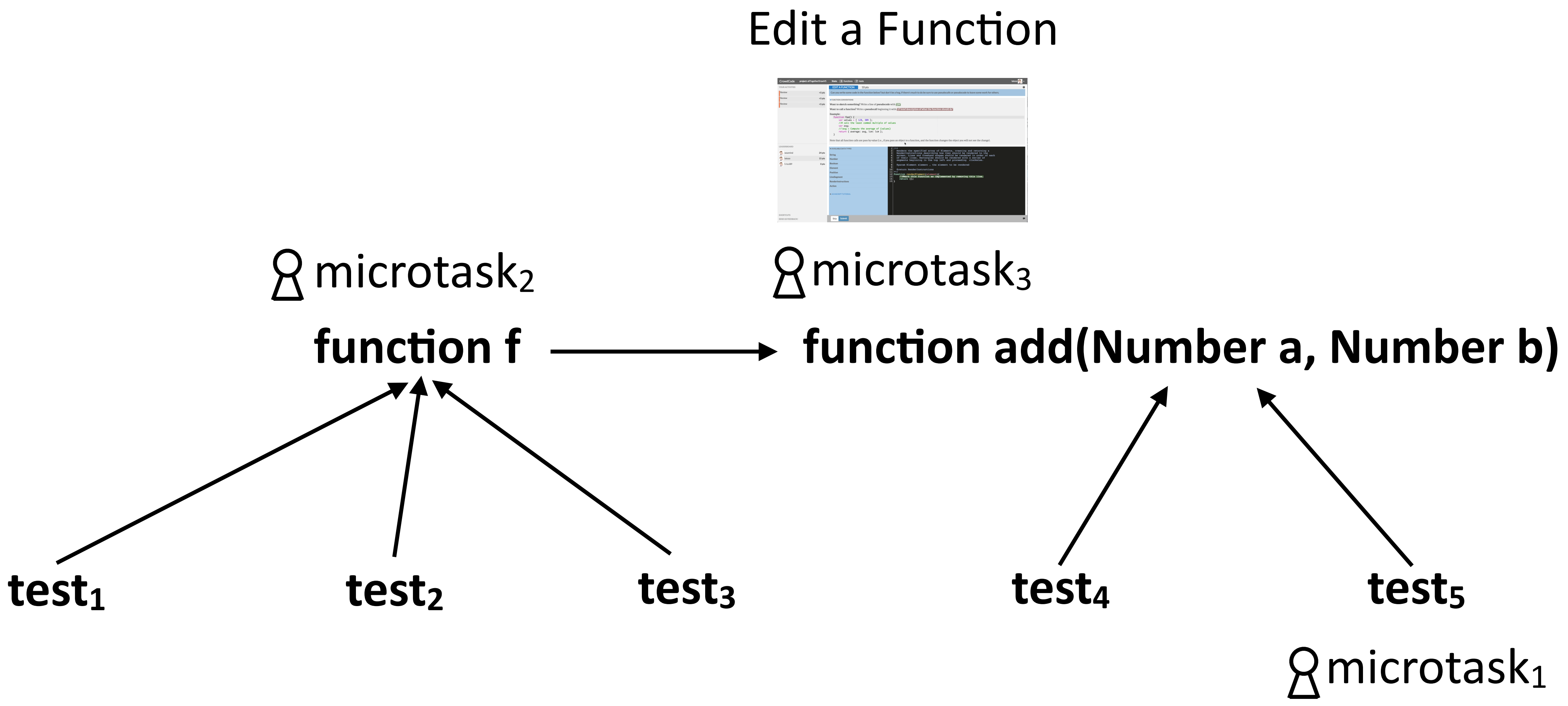





!described
described
!written
testRun
described
written
buggy
described
written
!buggy

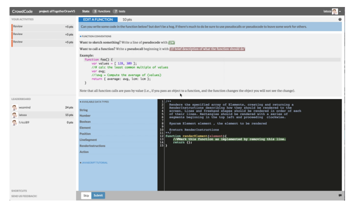

!described
described
!written
testRun
described
written
buggy
described
written
!buggy

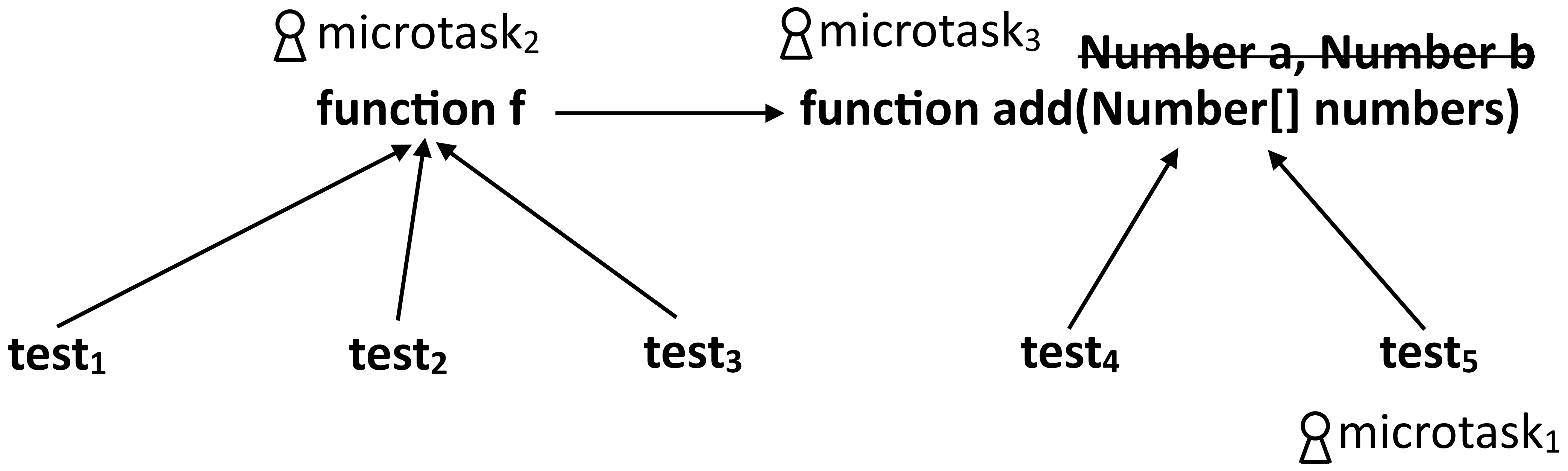
Coordinating work

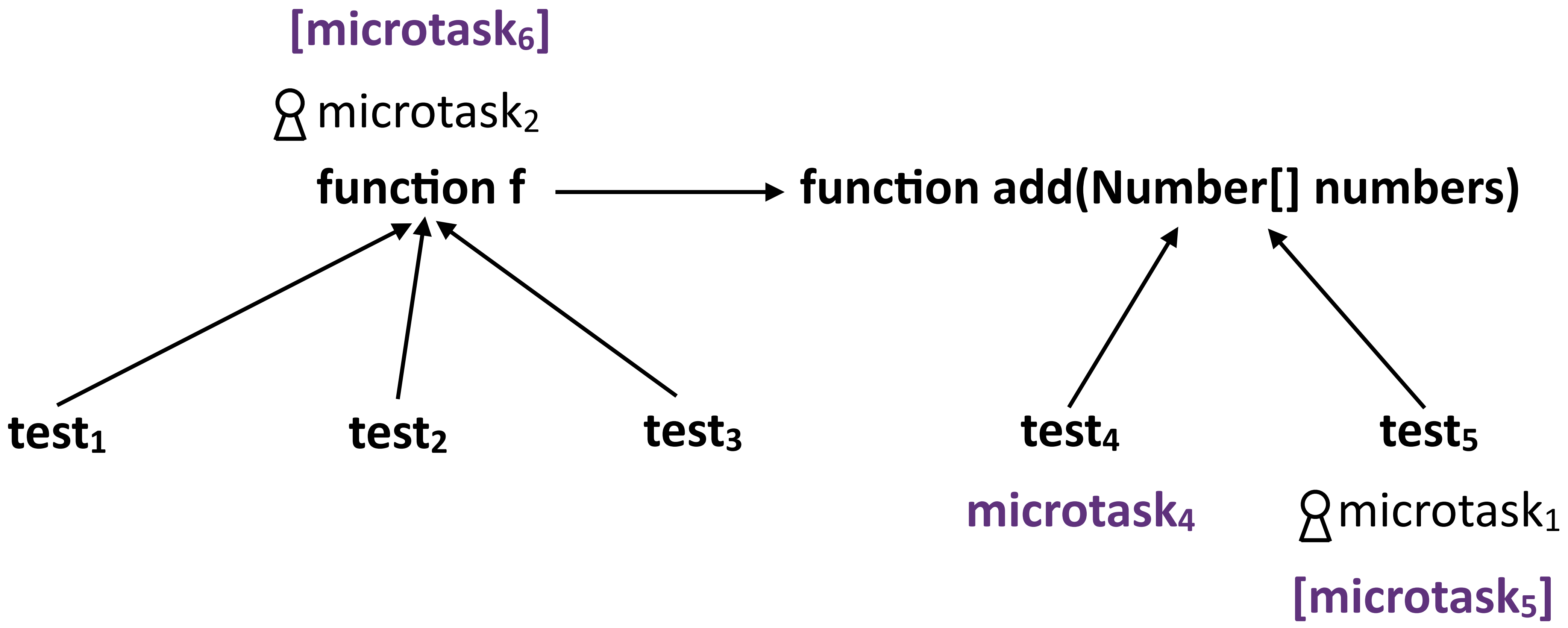


- One microtask in progress per artifact

Edit a Function



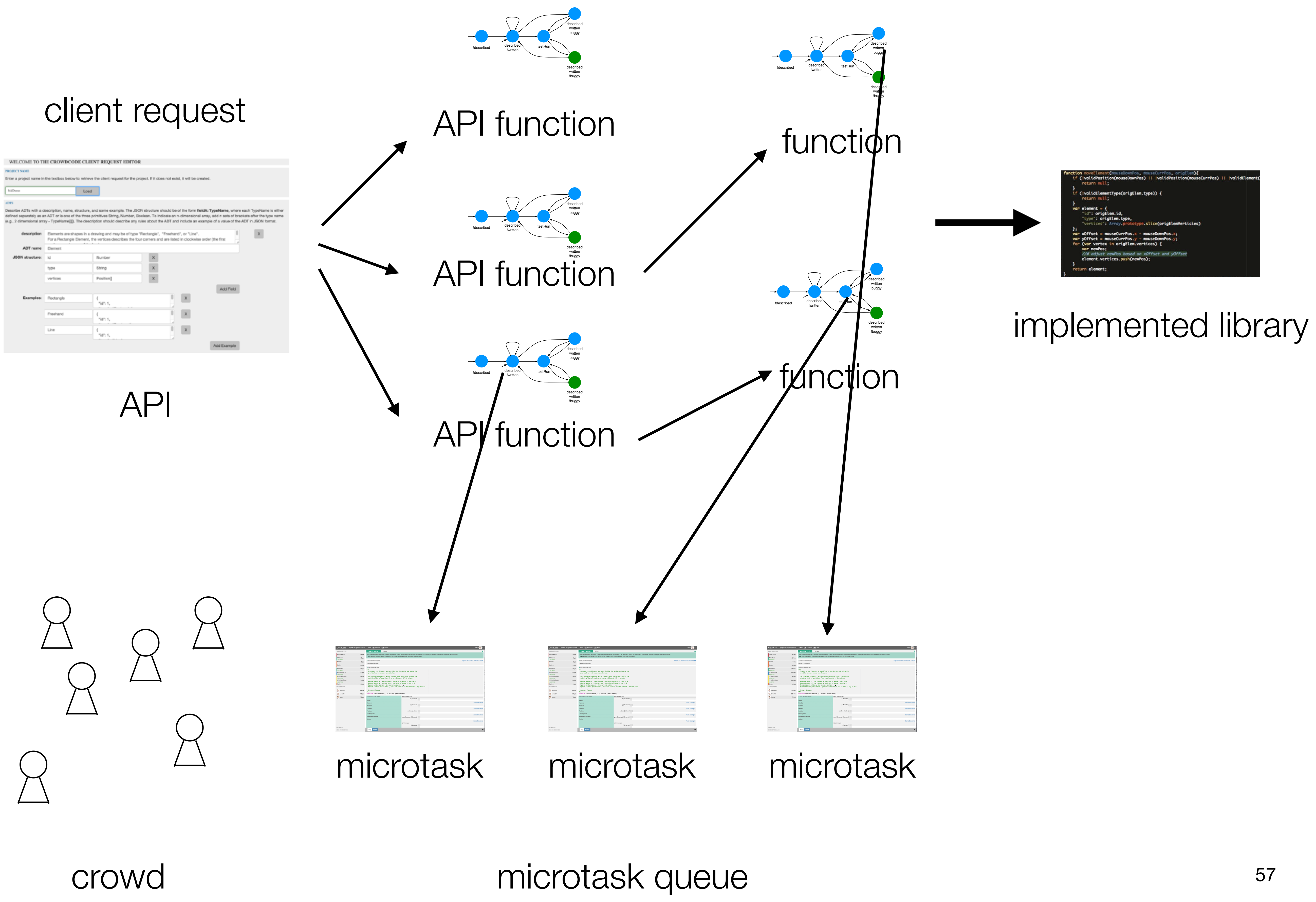



[microtask6]
microtask2
function f
function add(Number[] numbers)
test1
test2
test3
test4
test5
microtask4
microtask1
[microtask5]

Ensure quality through iterative work

- Key principle: any crowd authored content can be revised by crowd
- Sketch & revision w/ small contributions
- Report issues w/ dependent artifacts that can’t be directly edited
- Review & test

Workflow



WELCOME TO THE **CROWDCODE CLIENT REQUEST EDITOR**

PROJECT NAME

Enter a project name in the textbox below to retrieve the client request for the project. If it does not exist, it will be created.

fullDemo	Load

ADTS

Describe ADTs with a description, name, structure, and some example. The JSON structure should be of the form **fieldA: TypeName**, where each TypeName is either defined separately as an ADT or is one of the three primitives String, Number, Boolean. To indicate an n-dimensional array, add n sets of brackets after the type name (e.g., 2 dimensional array - TypeName[][]). The description should describe any rules about the ADT and include an example of a value of the ADT in JSON format.

description Elements are shapes in a drawing and may be of type "Rectangle", "Freehand", or "Line".
For a Rectangle Element, the vertices describes the four corners and are listed in clockwise order (the first

ADT name Element

JSON structure:		
	id	Number
	type	String
	vertices	Position[]

Add Field

Examples:		
	Rectangle	{ "id": 1,
	Freehand	{ "id": 1,
	Line	{ "id": 1,

Add Example

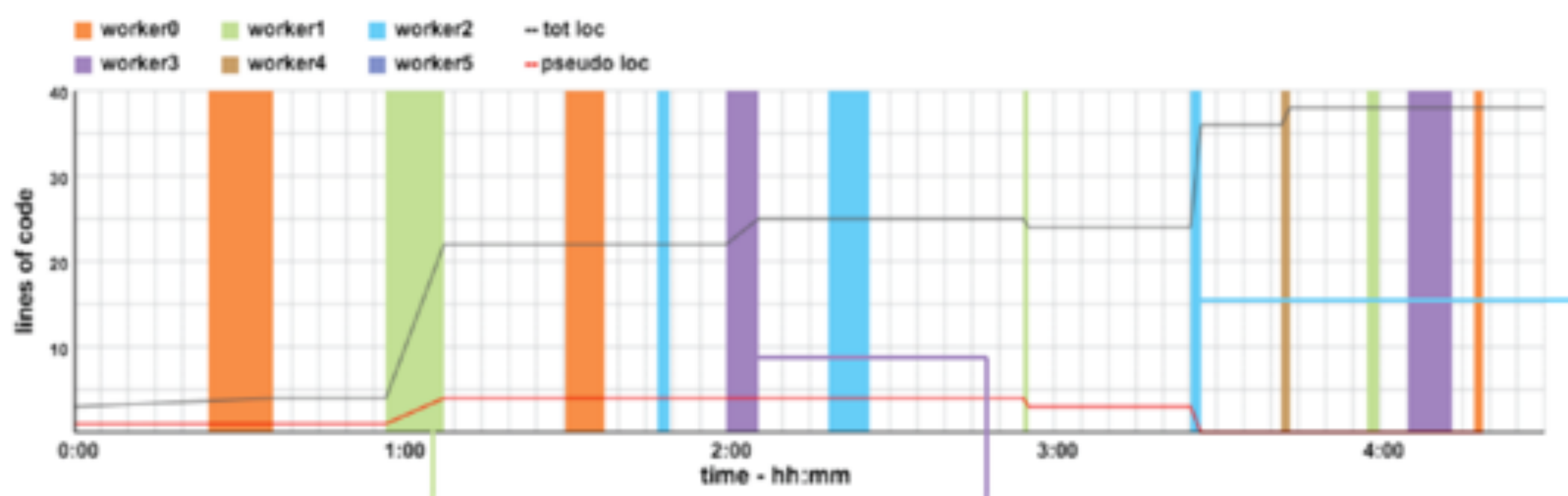
```
function moveElement(mouseDownPos, mouseCurrPos, origElem){
    if (!validPosition(mouseDownPos) || !validPosition(mouseCurrPos) || !validElement(
        return null;
    }
    if (!validElementType(origElem.type)) {
        return null;
    }
    var element = {
        "id": origElem.id,
        "type": origElem.type,
        "vertices": Array.prototype.slice(origElemVerticies)
    };
    var xOffset = mouseCurrPos.x - mouseDownPos.x;
    var yOffset = mouseCurrPos.y - mouseDownPos.y;
    for (var vertex in origElem.vertices) {
        var newPos;
        //# adjust newPos based on xOffset and yOffset
        element.vertices.push(newPos);
    }
    return element;
}
```

Results - Automatically generating microtasks

- Implemented 22 functions (490 lines of code), including 14 new functions
- Created 149 unit tests (2920 lines of code)

Microtask type	**Completed**		**Skipped**		**Reissued**		**Median time** (m:s)		**Total time** (h:m:s)	
Session	A	B	A	B	A	B	A	B	A	B
Review	260	227	22	22	-	-	1:27	1:14	9:29:32	6:43:43
Write test	158	102	22	7	40	41	1:29	1:21	6:35:41	3:15:12
Write function	44	56	25	21	16	22	4:57	2:31	3:59:28	3:40:03
Write test cases	40	30	9	4	11	13	3:50	2:28	2:57:02	2:05:53
Debug test failure	14	18	5	6	1	4	2:32	4:00	0:57:22	1:21:21
Write function	8	16	3	0	0	10	3:12	2:44	0:30:21	1:03:58
Write call	7	9	2	2	0	3	1:37	2:28	0:15:02	0:36:49
Reuse search	9	10	3	0	-	3	0:42	1:35	0:06:37	0:22:33
Total	540	468	91	62	68	96			24.51.0	19:09:32
Overall total	**1008**		**153**		**16**				**44:00:37**	

Results - Small contributions



A

```
function createAction(mouseDownPos, command, elements) {
 //# mark this function as complete removing this line
 //# mark this function as complete by removing this line
 if(command  == "Move"){
  var el = null;
  for (el in elements) {
   if (onOutline(mouseDownPos, el)) {
    return {
     "type":"Move",
     "elementId":el.id,
     "mouseDownPos":mouseDownPos
    };
   }
  }
 }else if(command == "Line" || command == "Freehand"
             || command == "Rectangle"){
  //# handle Line
  //# handle Freehand
  //# handle Rectangle
 }else{
  return null;
 }
 return null;
}
```

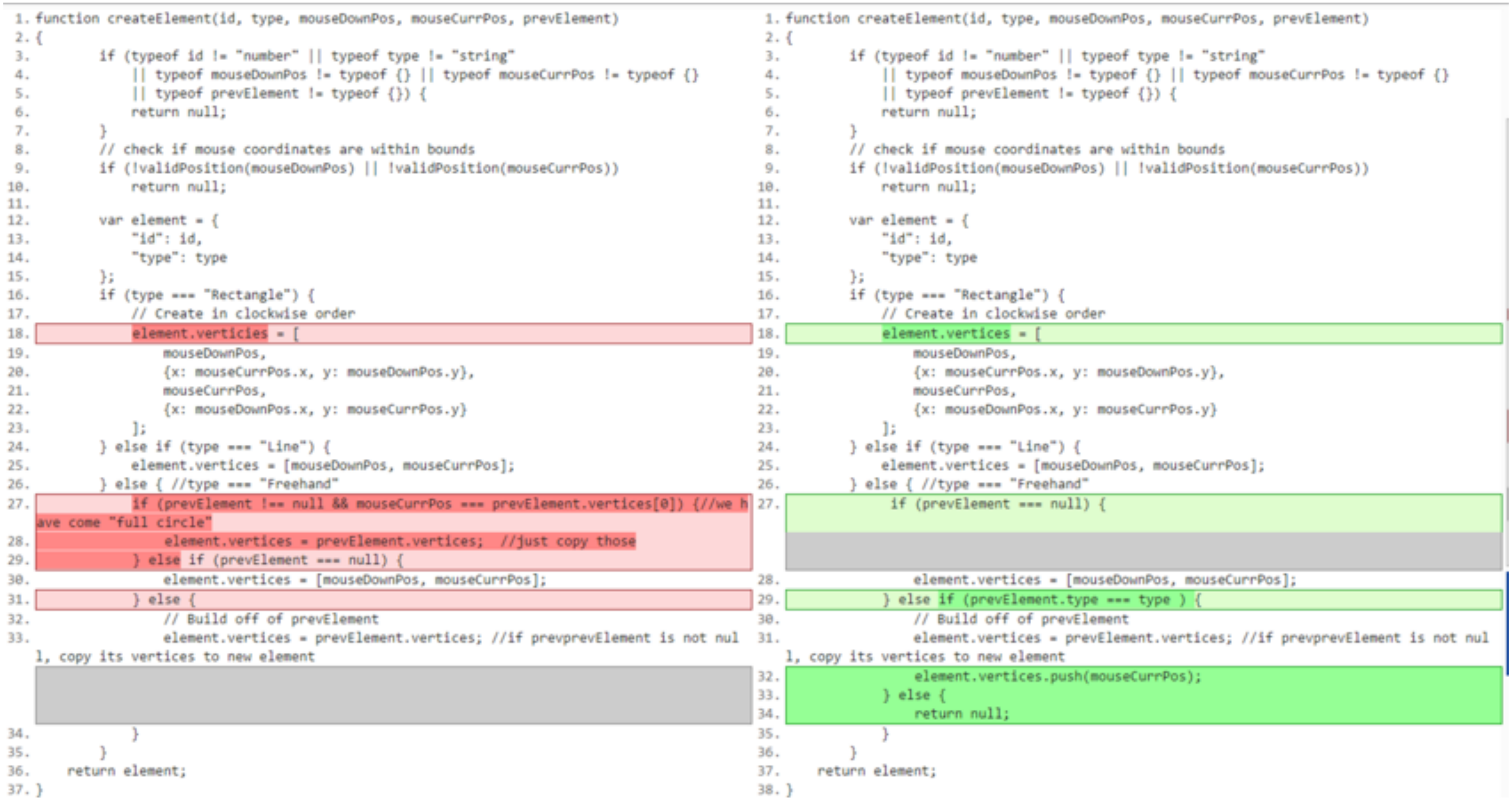
B

```
function createAction(mouseDownPos, command, elements) {
 //# mark this function as complete by removing this line
 if(command  == "Move"){
  var el = null;
  for (el in elements) {
   if (isOnOutline(mouseDownPos, el)) {
    return {
     "type":"Move",
     "elementId":el.id,
     "mouseDownPos":mouseDownPos
    };
   }
  }
 } else if(command == "Line" || command == "Freehand"
             || command == "Rectangle"){
  //# handle Line
  //# handle Freehand
  //# handle Rectangle
 }else{
  return null;
 } else {
  var nextId = getNextId(elements);
  if (command == "Line") {
  //# handle Line and return it
  } else if (command == "Freehand") {
  //# handle Freehand and return it
  } else if (command == "Rectangle") {
  //# handle Rectangle and return it
  }
 }
 return null;
}
```

C

```
function createAction(mouseDownPos, command,
             elements) {
 if(command  == "Move"){
  var el = null;
  for (el in elements) {
   if (isOnOutline(mouseDownPos, el)) {
    return {
     "type":"Move",
     "elementId":el.id,
     "mouseDownPos":mouseDownPos
    };
   }
  }
 } else {
  var nextId = getNextValidId(elements);
  if (command == "Line") {
  //# handle Line and return it
   return {
    "type": "Line",
    "elementId": nextId,
    "mouseDownPos": mouseDownPos
   };
  } else if (command == "Freehand") {
  //# handle Freehand and return it
   return {
    "type": "Freehand",
    "elementId": nextId,
    "mouseDownPos": mouseDownPos
   };
  } else if (command == "Rectangle") {
  //# handle Rectangle and return it
   return {
    "type": "Rectangle",
    "elementId": nextId,
    "mouseDownPos": mouseDownPos
   };
  }
 }
 return null;
}
```

Results - Fixing bugs



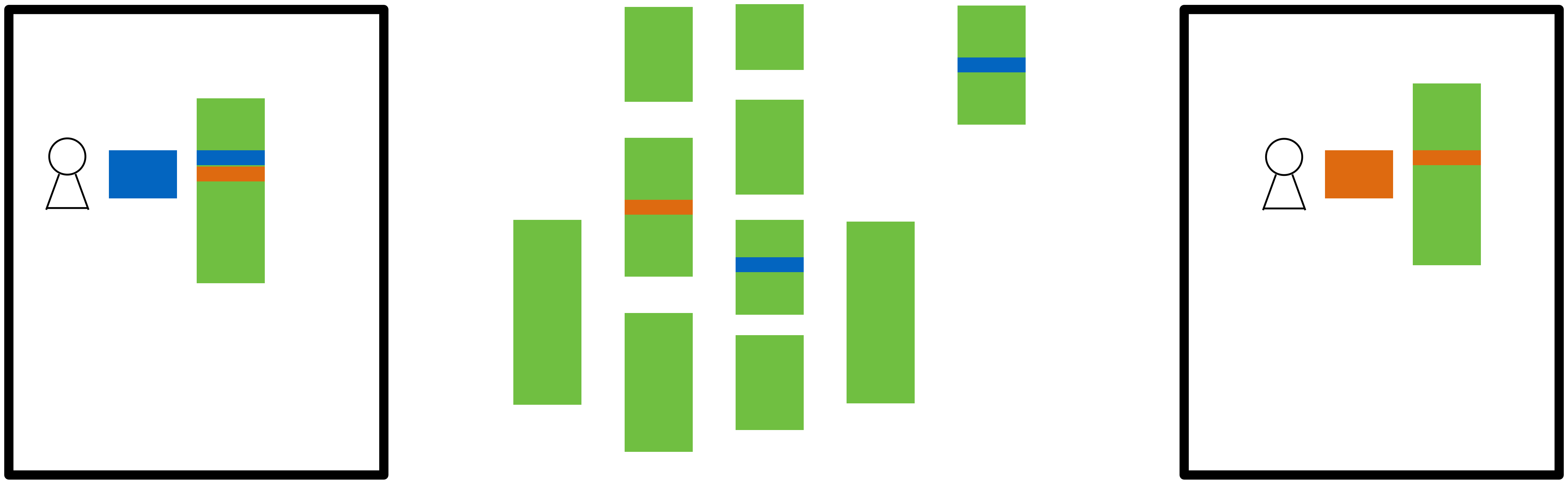
```
function createElement(id, type, mouseDownPos, mouseCurrPos, prevElement)
{
        if (typeof id != "number" || typeof type != "string"
            || typeof mouseDownPos != typeof {} || typeof mouseCurrPos != typeof {}
            || typeof prevElement != typeof {}) {
            return null;
        }
        // check if mouse coordinates are within bounds
        if (!validPosition(mouseDownPos) || !validPosition(mouseCurrPos))
            return null;

        var element = {
            "id": id,
            "type": type
        };
        if (type === "Rectangle") {
            // Create in clockwise order
            element.verticies = [
                mouseDownPos,
                {x: mouseCurrPos.x, y: mouseDownPos.y},
                mouseCurrPos,
                {x: mouseDownPos.x, y: mouseCurrPos.y}
            ];
        } else if (type === "Line") {
            element.vertices = [mouseDownPos, mouseCurrPos];
        } else { //type === "Freehand"
            if (prevElement !== null && mouseCurrPos === prevElement.vertices[0]) {//we have come "full circle"
                element.vertices = prevElement.vertices;  //just copy those
            } else if (prevElement === null) {
                element.vertices = [mouseDownPos, mouseCurrPos];
            } else {
                // Build off of prevElement
                element.vertices = prevElement.vertices; //if prevprevElement is not null, copy its vertices to new element
            }
        }
    return element;
}
```

```
function createElement(id, type, mouseDownPos, mouseCurrPos, prevElement)
{
        if (typeof id != "number" || typeof type != "string"
            || typeof mouseDownPos != typeof {} || typeof mouseCurrPos != typeof {}
            || typeof prevElement != typeof {}) {
            return null;
        }
        // check if mouse coordinates are within bounds
        if (!validPosition(mouseDownPos) || !validPosition(mouseCurrPos))
            return null;

        var element = {
            "id": id,
            "type": type
        };
        if (type === "Rectangle") {
            // Create in clockwise order
            element.vertices = [
                mouseDownPos,
                {x: mouseCurrPos.x, y: mouseDownPos.y},
                mouseCurrPos,
                {x: mouseDownPos.x, y: mouseCurrPos.y}
            ];
        } else if (type === "Line") {
            element.vertices = [mouseDownPos, mouseCurrPos];
        } else { //type === "Freehand"
             if (prevElement === null) {
                element.vertices = [mouseDownPos, mouseCurrPos];
            } else if (prevElement.type === type ) {
                // Build off of prevElement
                element.vertices = prevElement.vertices; //if prevprevElement is not null, copy its vertices to new element
                element.vertices.push(mouseCurrPos);
            } else {
                return null;
            }
        }
    return element;
}
```

Still a need for coordinating crosscutting information



- Much of the crosscutting information related to **decisions**
  - Interpretation of requirements & specifications
  - Representation of state in data structures
- Building good interface often as much work (or more) than doing implementation
  - Need for global view for the crowd to be more involved in crafting API

Scaffolding coordination and knowledge sharing

Idea

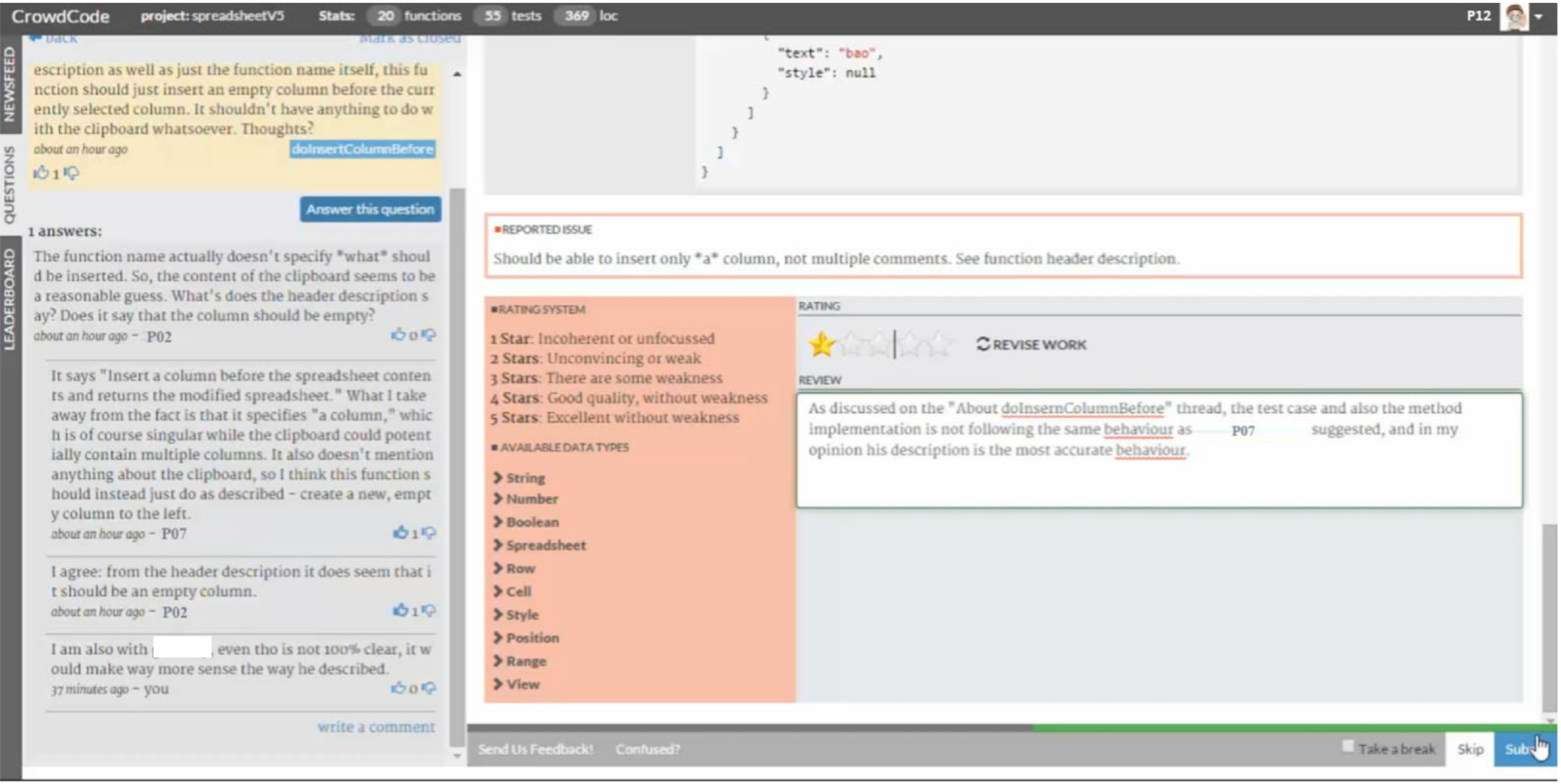
make design decisions **explicit**

link artifacts to design decisions

enable developers to coordinate by **discussing** design decisions

LaToza, Di Lecce, Ricci, Towne, van der Hoek. Ask the crowd: Scaffolding coordination and knowledge sharing in microtask programming. VL/HCC 2015.

Extended environment w/ Q&A system directly connected to code



escription as well as just the function name itself, this function should just insert an empty column before the currently selected column. It shouldn't have anything to do with the clipboard whatsoever. Thoughts?
about an hour ago doInsertColumnBefore
1

Answer this question

1 answers:

The function name actually doesn't specify "what" should be inserted. So, the content of the clipboard seems to be a reasonable guess. What's does the header description say? Does it say that the column should be empty?
about an hour ago – P02 0

It says "Insert a column before the spreadsheet contents and returns the modified spreadsheet." What I take away from the fact is that it specifies "a column," which is of course singular while the clipboard could potentially contain multiple columns. It also doesn't mention anything about the clipboard, so I think this function should instead just do as described – create a new, empty column to the left.
about an hour ago – P07 1

I agree: from the header description it does seem that it should be an empty column.
about an hour ago – P02 1

I am also with [redacted] even tho is not 100% clear, it would make way more sense the way he described.
37 minutes ago – you 0

write a comment

```
        "text": "bao",
        "style": null
      }
    ]
  }
 ]
}
```

REPORTED ISSUE
Should be able to insert only "a" column, not multiple comments. See function header description.

RATING SYSTEM
1 Star: Incoherent or unfocussed
2 Stars: Unconvincing or weak
3 Stars: There are some weakness
4 Stars: Good quality, without weakness
5 Stars: Excellent without weakness

AVAILABLE DATA TYPES
- String
- Number
- Boolean
- Spreadsheet
- Row
- Cell
- Style
- Position
- Range
- View

RATING
REVISE WORK

REVIEW
As discussed on the "About doInsernColumnBefore" thread, the test case and also the method implementation is not following the same behaviour as P07 suggested, and in my opinion his description is the most accurate behaviour.

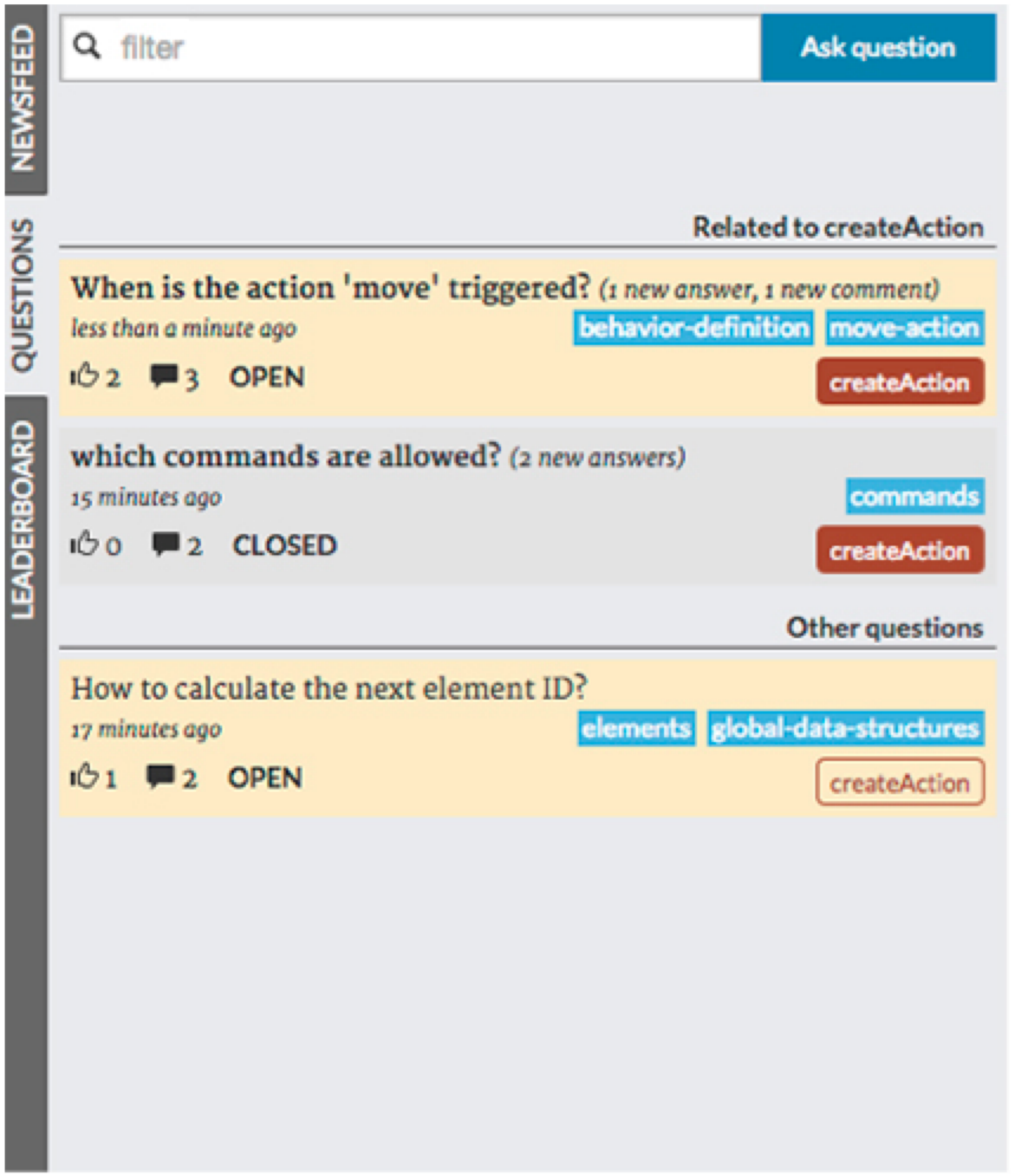
Developers can search for existing answers

Developers can search questions with full text **filter**

Questions marked as **closed** (yellow) or **open** (gray)

Questions marked as **relevant** to current artifact (top) and all other questions

If no answer, can ask new question.



Related to createAction

When is the action 'move' triggered? *(1 new answer, 1 new comment)*
less than a minute ago behavior-definition move-action
2 3 OPEN createAction

which commands are allowed? *(2 new answers)*
15 minutes ago commands
0 2 CLOSED createAction

Other questions

How to calculate the next element ID?
17 minutes ago elements global-data-structures
1 2 OPEN createAction

Developers can discuss questions and answers

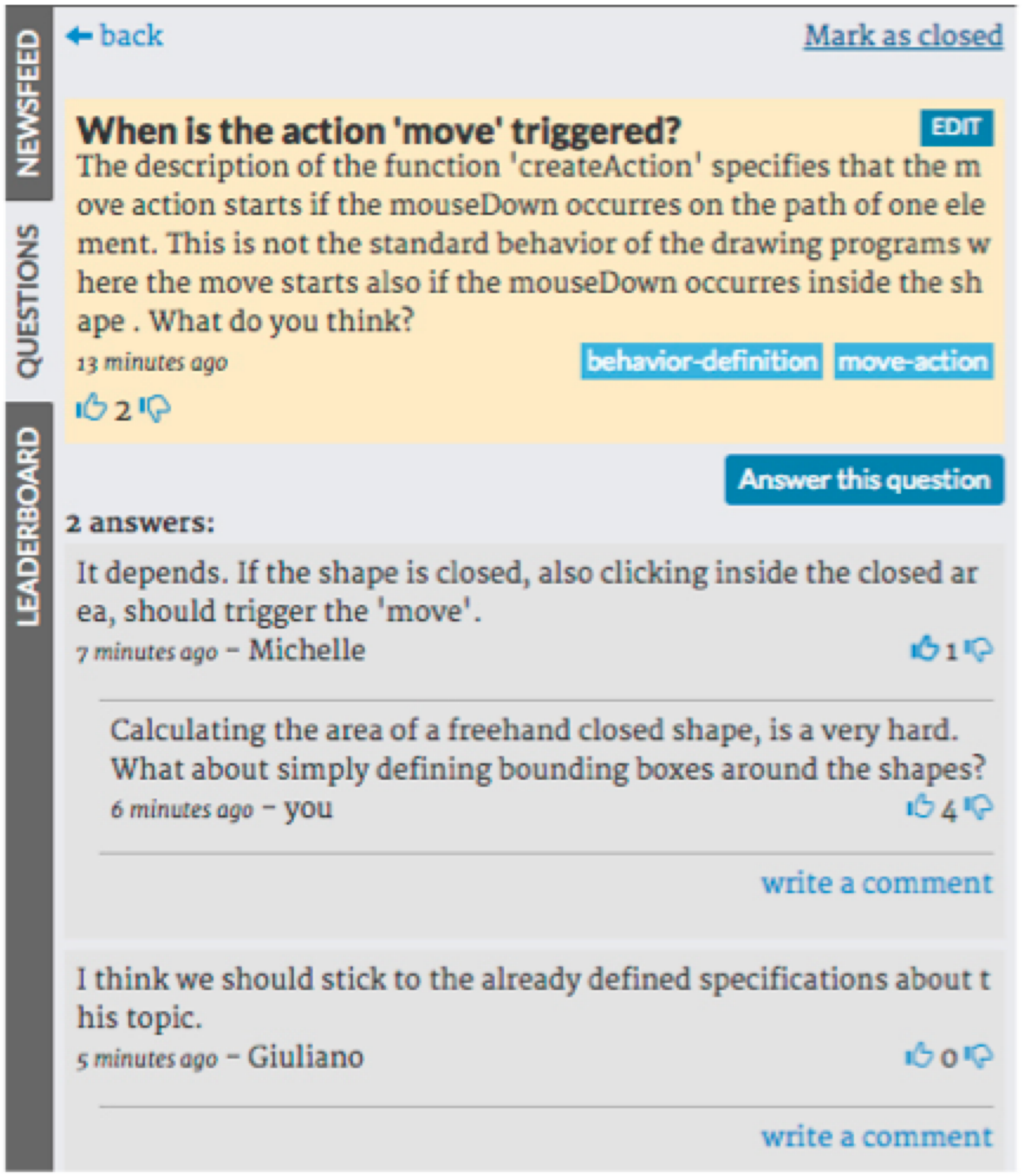
Any worker may at **any time** discuss question.

Threaded into answers & comments.

Up vote & down-vote.

Discussion **synchronous** (real time updates) & **asynchronous** (notifications on issues developers follows)

Question title, text, tags, open/closed **collaboratively** editable.



When is the action 'move' triggered?
The description of the function 'createAction' specifies that the move action starts if the mouseDown occurres on the path of one element. This is not the standard behavior of the drawing programs where the move starts also if the mouseDown occurres inside the shape . What do you think?
13 minutes ago — behavior-definition, move-action — 2

2 answers:

It depends. If the shape is closed, also clicking inside the closed area, should trigger the 'move'.
7 minutes ago – Michelle — 1

Calculating the area of a freehand closed shape, is a very hard. What about simply defining bounding boxes around the shapes?
6 minutes ago – you — 4

I think we should stick to the already defined specifications about this topic.
5 minutes ago – Giuliano — 0

Organizing discussion around decisions helps structure coordination

Workers used Q&A to ask questions on variety of topics
— crosscutting decisions
— clarify function descriptions
— state decisions already made, indicating convention
— ask questions about using CrowdCode environment
— explicit coordination

Compared to unstructured global chat, several preferred Q&A
— “easier to transmit and spread the information” (P2)
— easier to “find relevant issues very easily” (P5)
— better than “tutorials and documentation” (P18)
— less distracting, easier to reach agreement, easier to get up to speed

Some limitations

- Lots of work for client to craft the right API
- Only for code, not UI
- No independent consideration of alternatives
    - Independence important for generating diverse ideas
    - Valuable for important design decisions?

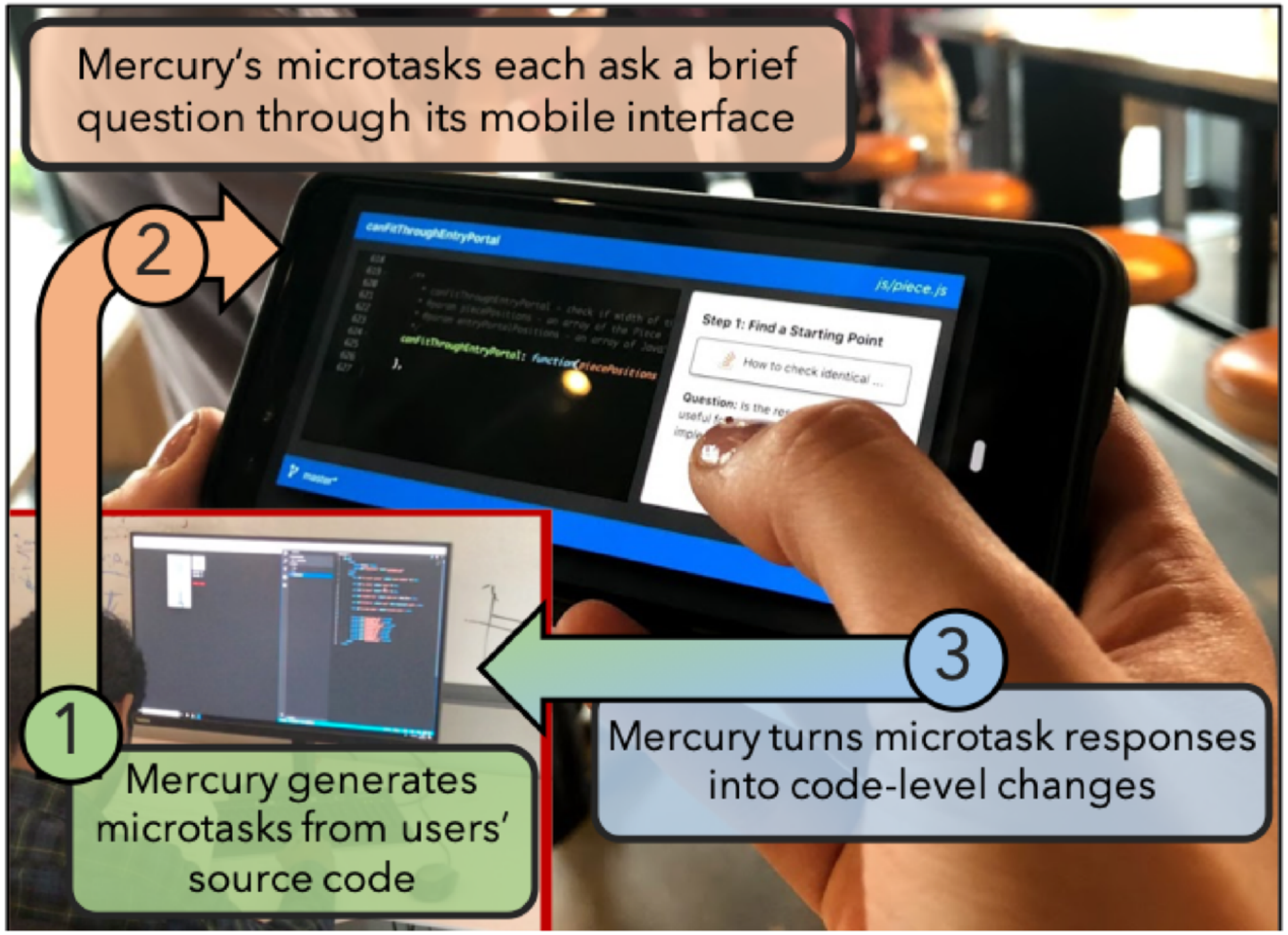

Mercury's microtasks each ask a brief question through its mobile interface
2
1
Mercury generates microtasks from users' source code
3
Mercury turns microtask responses into code-level changes
canFitThroughEntryPortal
js/piece.js
Step 1: Find a Starting Point
master*

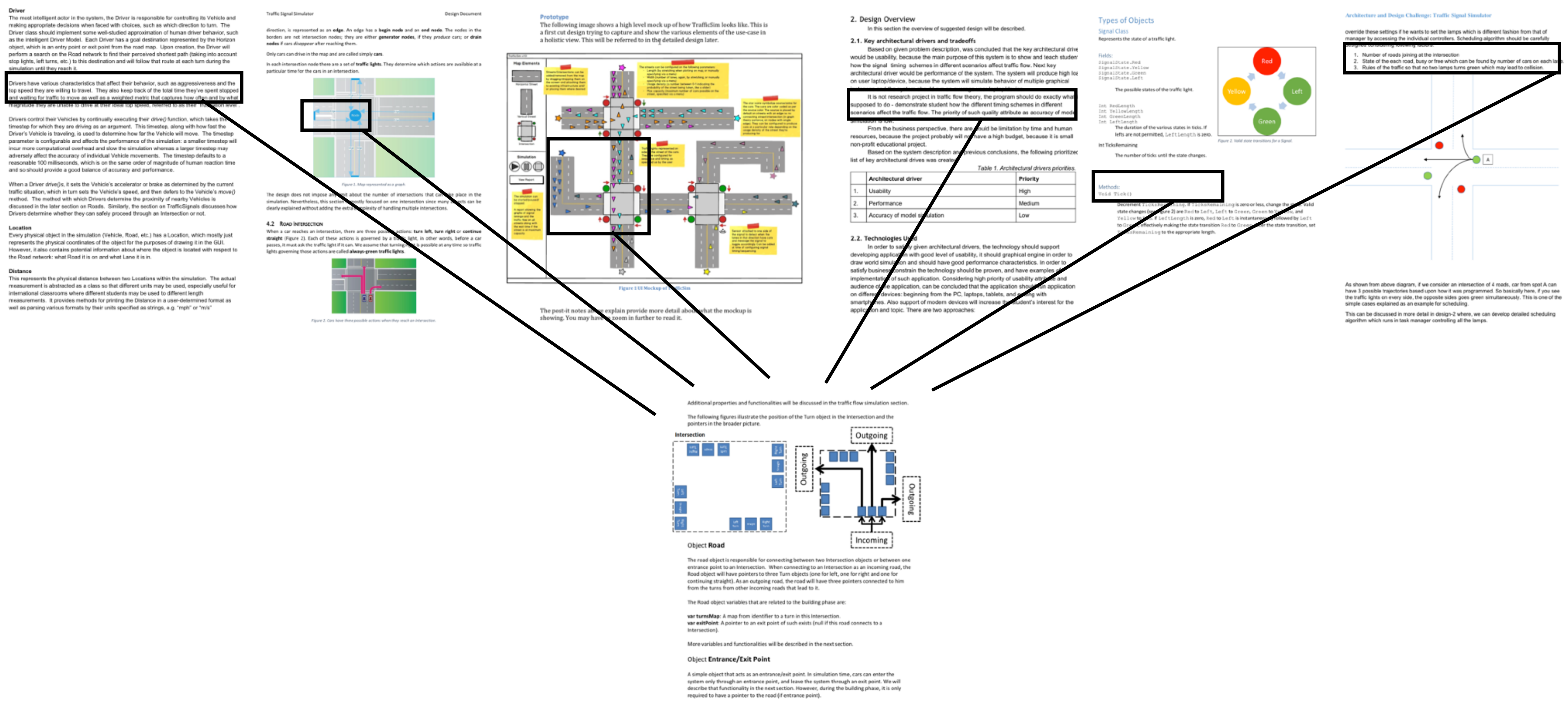
Figure 1: Mercury allows programmers to continue their work on-the-go. (1) When a user leaves their workstation, Mercury generates microtasks from their code, (2) then serves the tasks to their mobile device. These tasks are brief and require little attention. (3) Finally, Mercury integrates the user's microtask responses into the their workstation's source files.

https://www.youtube.com/watch?v=Urh-TQk4ebQ&feature=youtu.be

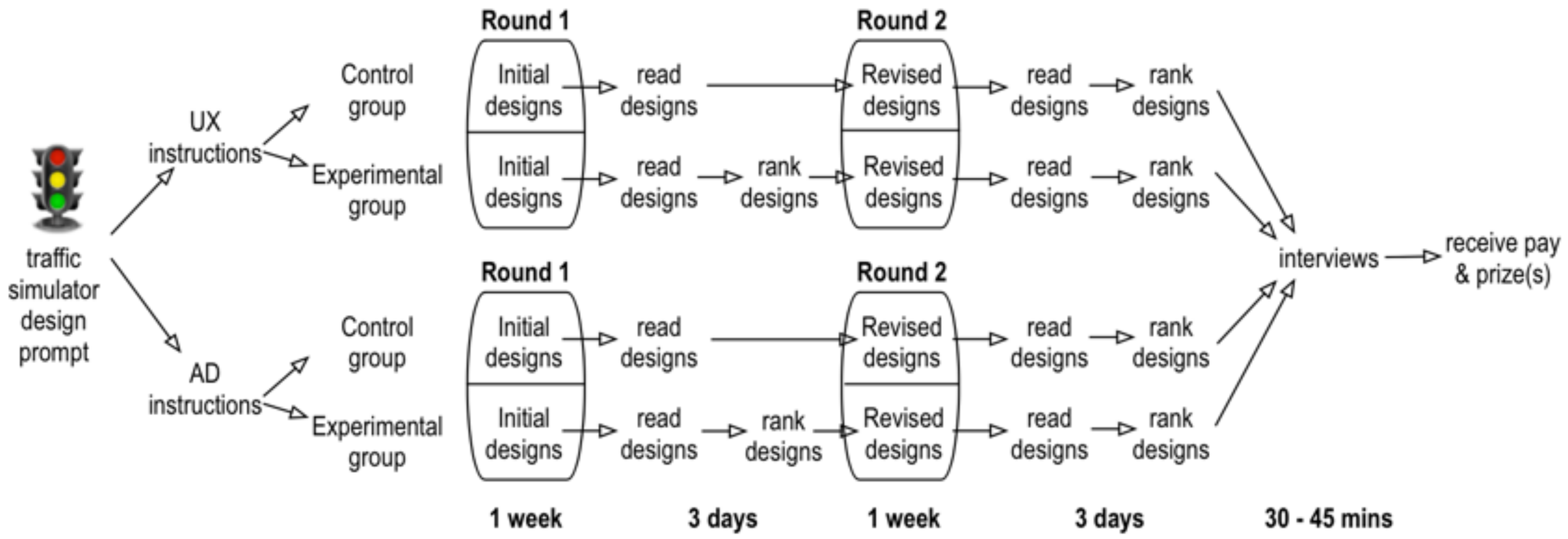
Alex C. Williams, Harmanpreet Kaur, Shamsi Iqbal, Ryen W. White, Jaime Teevan, and Adam Fourney. 2019. Mercury: Empowering Programmers' Mobile Work Practices with Microproductivity. In Proceedings of the 32nd Annual ACM Symposium on User Interface Software and Technology (UIST '19). ACM, New York, NY, USA, 81-94. DOI: https://doi.org/10.1145/3332165.3347932

Software design recombination

Consider alternatives separately created by **many**, iteratively selecting and **recombining** the best ideas



UX and architectural design competitions



12 UX participants 10 AD participants

Designs independently **scored** on 1-7 scale by 4 expert panelists
Evaluated on elegance, clarity, and completeness

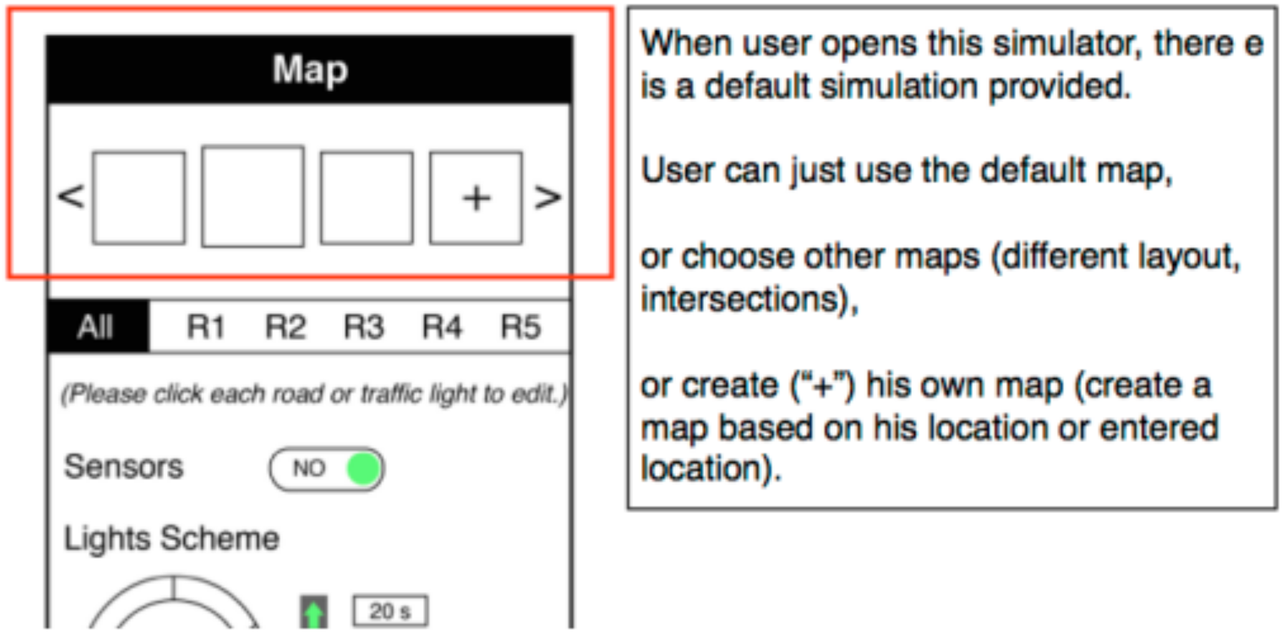
LaToza, Chen, Jiang, Zhao, van der Hoek. Borrowing from the crowd: A study of recombination in software design competitions. ICSE 2015.

Designs increased in quality

User experience designs:	**+1.8 points** out of 21 (p = .03) 75% of designs improved
Architectural designs:	**+1.6 points** out of 21 (p = .009) 80% of designs improved

LaToza, Chen, Jiang, Zhao, van der Hoek. Borrowing from the crowd: A study of recombination in software design competitions. ICSE 2015.

Designers borrowed features and presentation elements



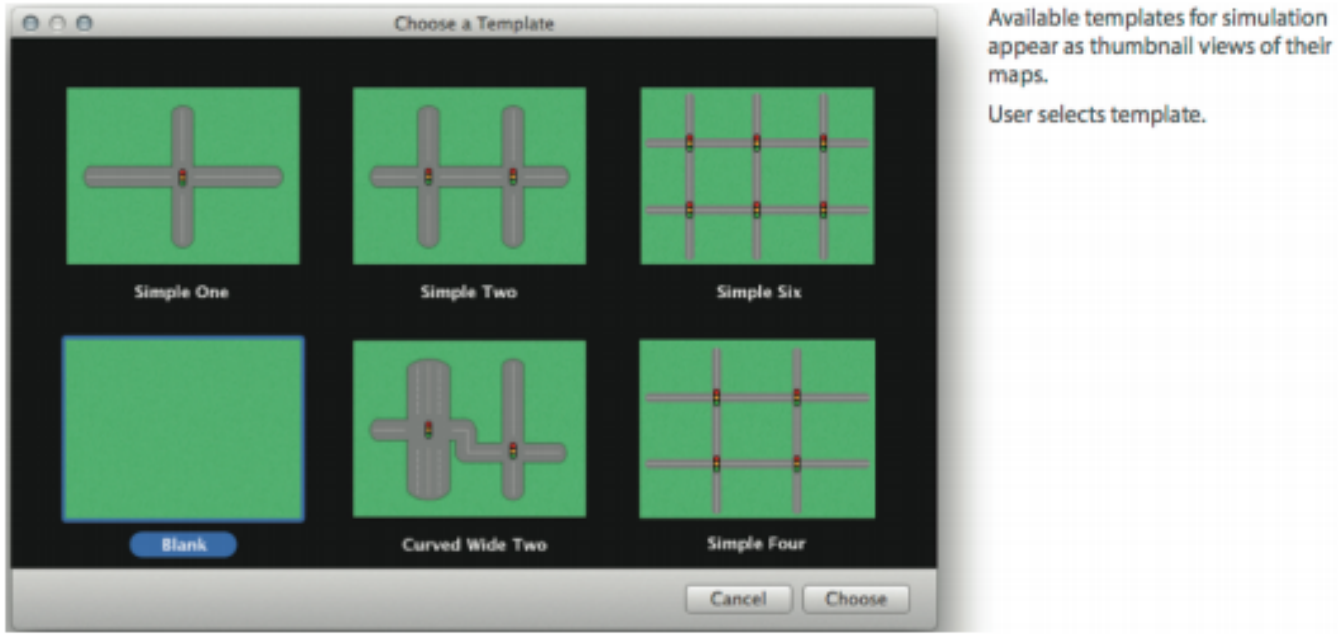
When user opens this simulator, there e is a default simulation provided.

User can just use the default map,

or choose other maps (different layout, intersections),

or create ("+") his own map (create a map based on his location or entered location).

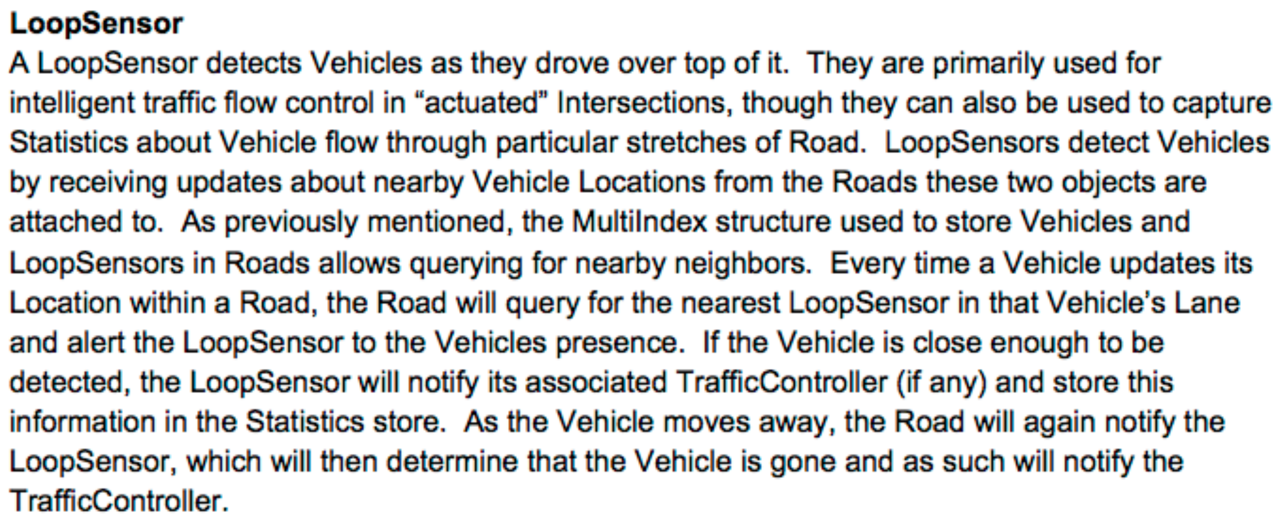
(a) Pre-designed templates - UE4, Round 1



Available templates for simulation appear as thumbnail views of their maps.

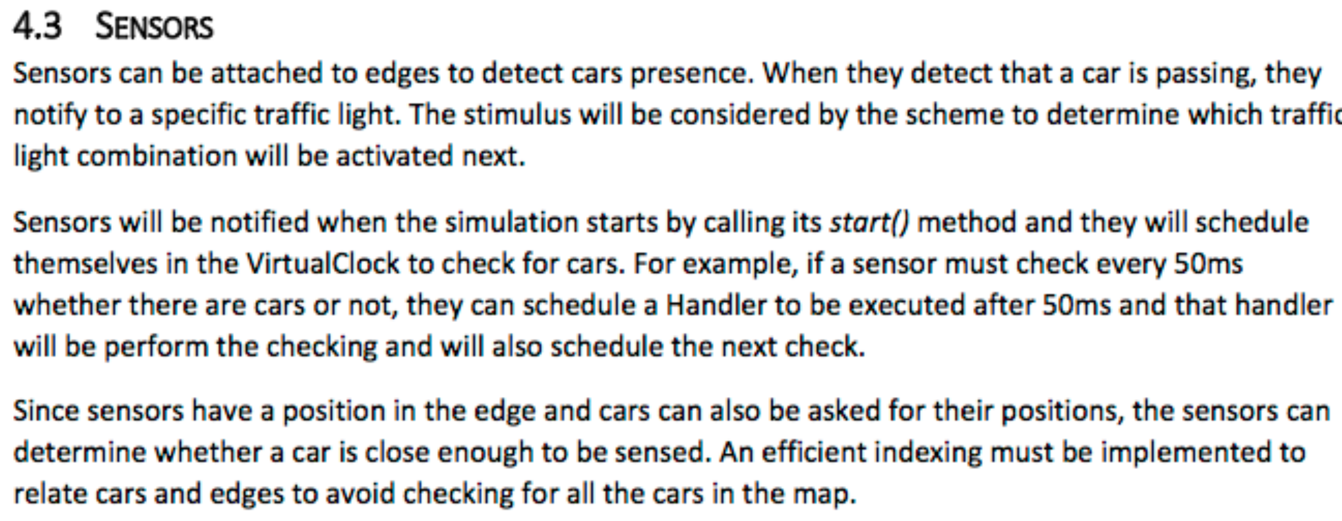
User selects template.

(b) Pre-designed templates - UE2, Round 2



LoopSensor
A LoopSensor detects Vehicles as they drove over top of it. They are primarily used for intelligent traffic flow control in "actuated" Intersections, though they can also be used to capture Statistics about Vehicle flow through particular stretches of Road. LoopSensors detect Vehicles by receiving updates about nearby Vehicle Locations from the Roads these two objects are attached to. As previously mentioned, the MultiIndex structure used to store Vehicles and LoopSensors in Roads allows querying for nearby neighbors. Every time a Vehicle updates its Location within a Road, the Road will query for the nearest LoopSensor in that Vehicle's Lane and alert the LoopSensor to the Vehicles presence. If the Vehicle is close enough to be detected, the LoopSensor will notify its associated TrafficController (if any) and store this information in the Statistics store. As the Vehicle moves away, the Road will again notify the LoopSensor, which will then determine that the Vehicle is gone and as such will notify the TrafficController.

Source design



4.3 SENSORS

Sensors can be attached to edges to detect cars presence. When they detect that a car is passing, they notify to a specific traffic light. The stimulus will be considered by the scheme to determine which traffic light combination will be activated next.

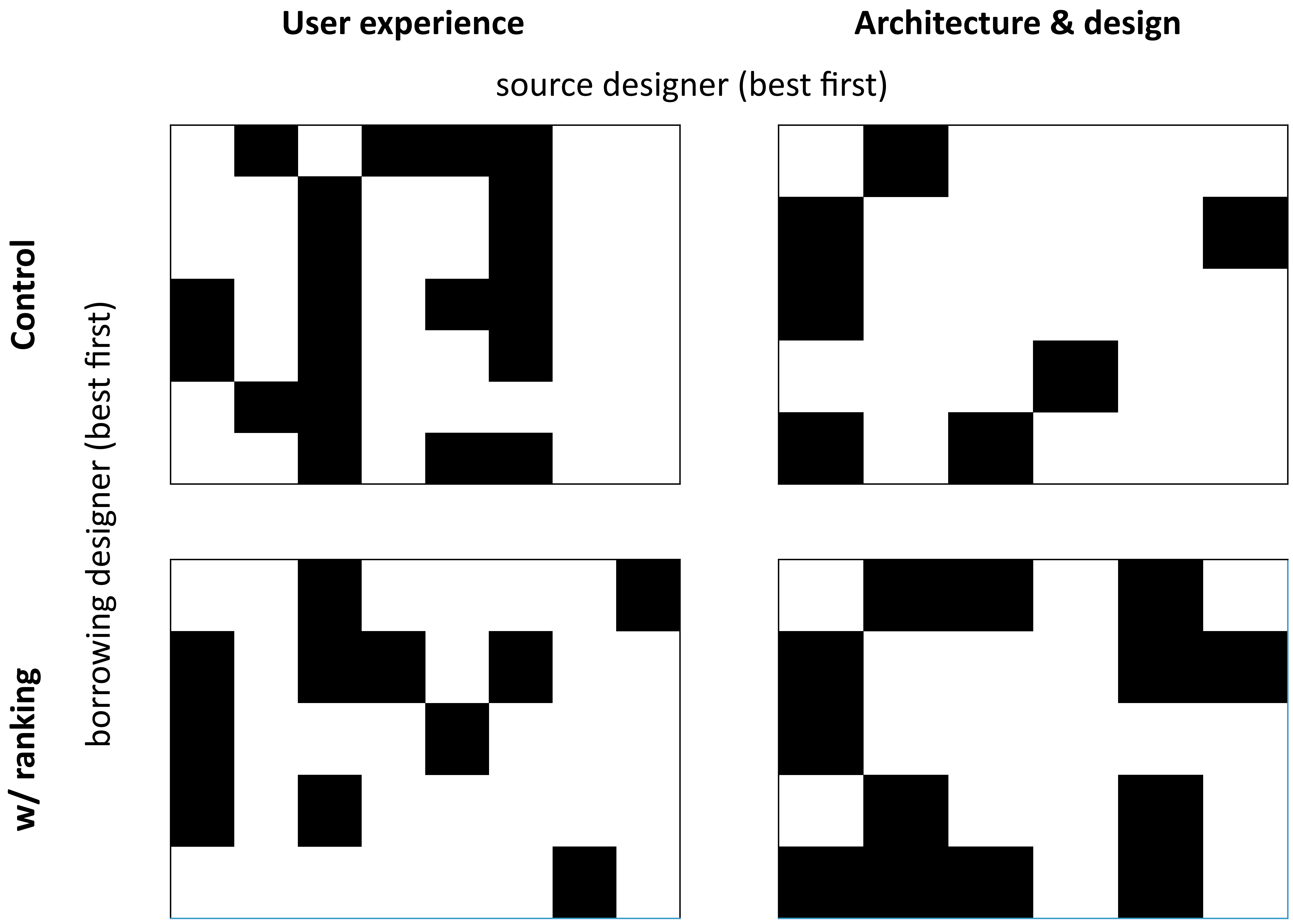
Sensors will be notified when the simulation starts by calling its *start()* method and they will schedule themselves in the VirtualClock to check for cars. For example, if a sensor must check every 50ms whether there are cars or not, they can schedule a Handler to be executed after 50ms and that handler will be perform the checking and will also schedule the next check.

Since sensors have a position in the edge and cars can also be asked for their positions, the sensors can determine whether a car is close enough to be sensed. An efficient indexing must be implemented to relate cars and edges to avoid checking for all the cars in the map.

Revised design

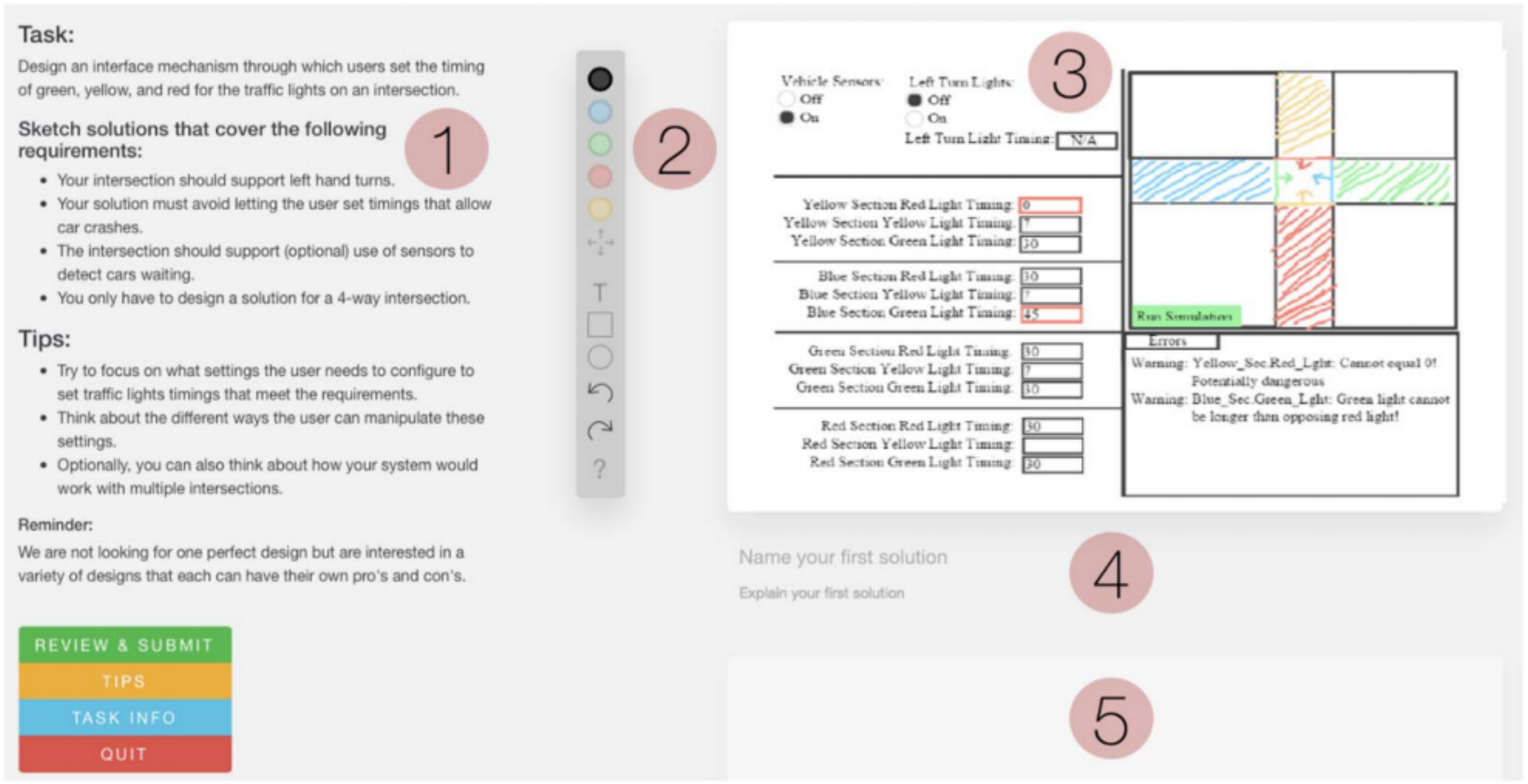
LaToza, Chen, Jiang, Zhao, van der Hoek. Borrowing from the crowd: A study of recombination in software design competitions. ICSE 2015.

All designers borrowed



LaToza, Chen, Jiang, Zhao, van der Hoek. Borrowing from the crowd: A study of recombination in software design competitions. ICSE 2015.

Microtasking software design work



Task:

Design an interface mechanism through which users set the timing of green, yellow, and red for the traffic lights on an intersection.

Sketch solutions that cover the following requirements:

- Your intersection should support left hand turns.
- Your solution must avoid letting the user set timings that allow car crashes.
- The intersection should support (optional) use of sensors to detect cars waiting.
- You only have to design a solution for a 4-way intersection.

Tips:

- Try to focus on what settings the user needs to configure to set traffic lights timings that meet the requirements.
- Think about the different ways the user can manipulate these settings.
- Optionally, you can also think about how your system would work with multiple intersections.

Reminder:

We are not looking for one perfect design but are interested in a variety of designs that each can have their own pro's and con's.

Vehicle Sensors: Off [✓ On]

Left Turn Lights: [✓ Off] On

Left Turn Light Timing: N/A

Yellow Section Red Light Timing: 0
Yellow Section Yellow Light Timing: 7
Yellow Section Green Light Timing: 30

Blue Section Red Light Timing: 30
Blue Section Yellow Light Timing: 7
Blue Section Green Light Timing: 45

Green Section Red Light Timing: 30
Green Section Yellow Light Timing: 7
Green Section Green Light Timing: 30

Red Section Red Light Timing: 30
Red Section Yellow Light Timing:
Red Section Green Light Timing: 30

Errors

Warning: Yellow_Sec.Red_Lght: Cannot equal 0! Potentially dangerous

Warning: Blue_Sec.Green_Lght: Green light cannot be longer than opposing red light!

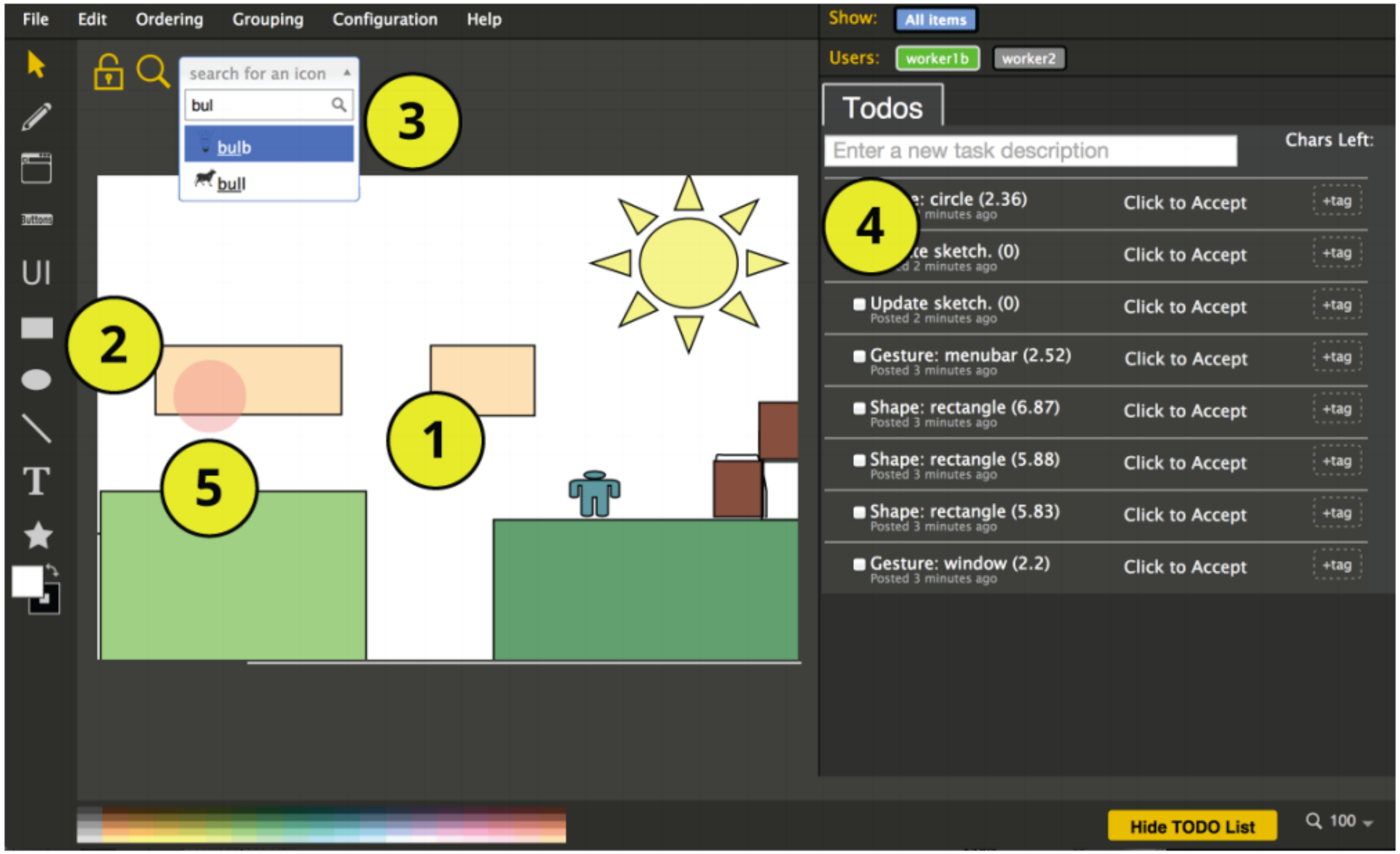
Name your first solution

Explain your first solution

Figure 1. CrowdDesign Platform: (1) sample task description, (2) tool bar for sketching, (3) sketch area, (4) input area for name of the solution alternative and its explanation, and (5) additional canvases, which can be reached by scrolling down.

Edgar R. Q. Weidema, Consuelo López, Sahand Nayebaziz, Fernando Spanghero, and André van der Hoek. 2016. Toward microtask crowdsourcing software design work. *International Workshop on CrowdSourcing in Software Engineering* (CSI-SE '16), 41-44.

Apparition

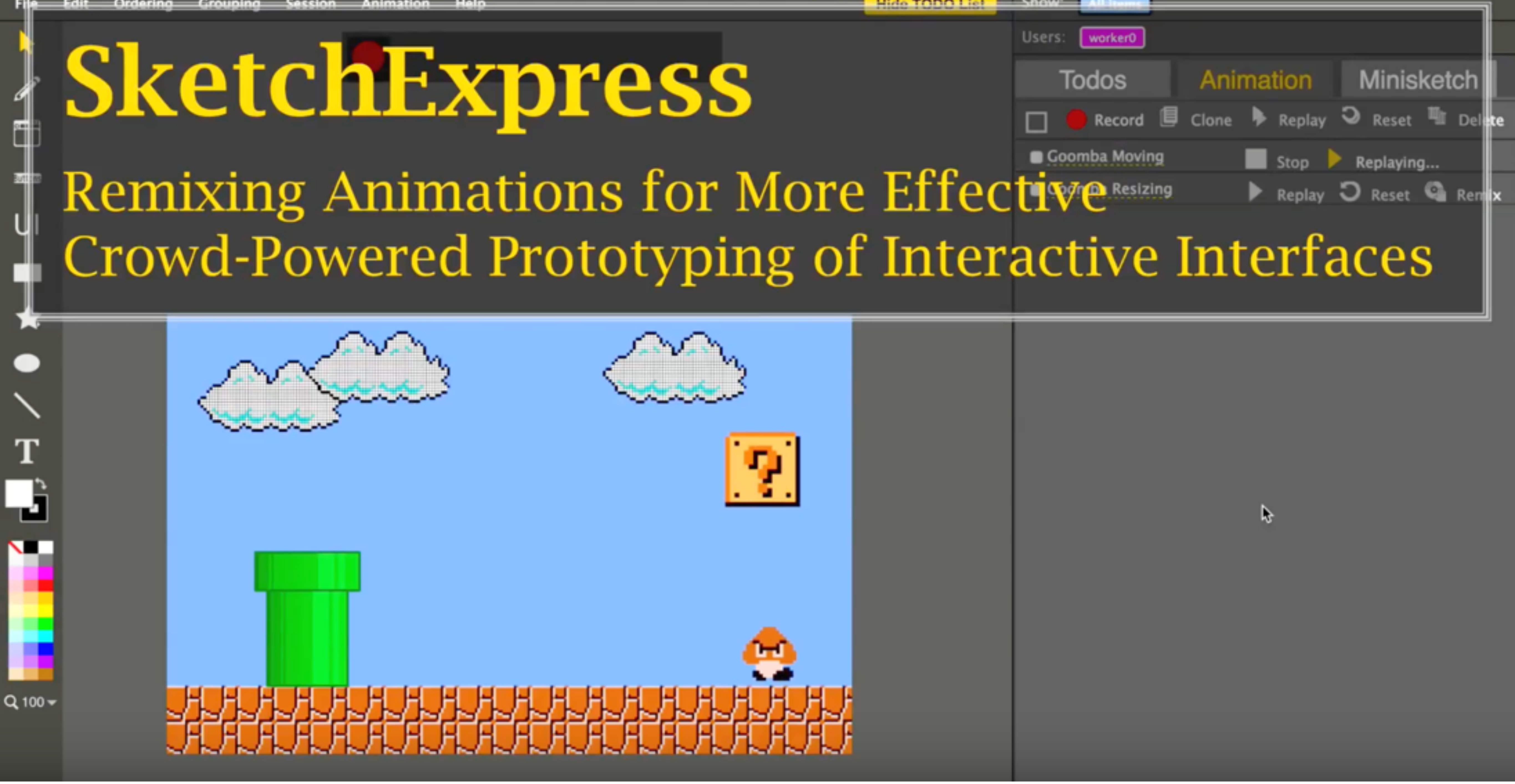


e: circle (2.36) minutes ago	Click to Accept	+tag
e sketch. (0) d 2 minutes ago	Click to Accept	+tag
Update sketch. (0) Posted 2 minutes ago	Click to Accept	+tag
Gesture: menubar (2.52) Posted 3 minutes ago	Click to Accept	+tag
Shape: rectangle (6.87) Posted 3 minutes ago	Click to Accept	+tag
Shape: rectangle (5.88) Posted 3 minutes ago	Click to Accept	+tag
Shape: rectangle (5.83) Posted 3 minutes ago	Click to Accept	+tag
Gesture: window (2.2) Posted 3 minutes ago	Click to Accept	+tag

Figure 1. Apparition allows designers to quickly create functional interface prototypes using sketches and verbal descriptions. (1) A collaborative canvas where the user(s) and workers can draw. (2) Drawing tools and icons to quicken workers' creation of UI elements. (3) A search function to help workers find relevant icons. (4) A to-do list that shows what has been drawn by the user but not yet converted to UI elements. Workers can "accept" tasks to signal what they are currently working on. (5) "In-progress" markers for workers to show where they are currently working to avoid conflicts.

https://www.youtube.com/watch?v=tBCB6P7FwWY

Walter S. Lasecki, Juho Kim, Nick Rafter, Onkur Sen, Jeffrey P. Bigham, and Michael S. Bernstein. 2015. Apparition: Crowdsourced User Interfaces that Come to Life as You Sketch Them. *CHI*, 1925-1934.



https://www.youtube.com/watch?time_continue=34&v=A_Pngz1mbDs&feature=emb_logo

SketchExpress: Remixing Animations For More Effective Crowd-Powered Prototyping Of Interactive Interfaces.(**paper**) Lee, S. W., Zhang, Y., Wong, I., Yang Y., O'Keefe, S., Lasecki, W.S., In Proceedings of *the ACM Symposium on User Interface Science and Technology (UIST)*. Quebec City, Canada.

Flash teams

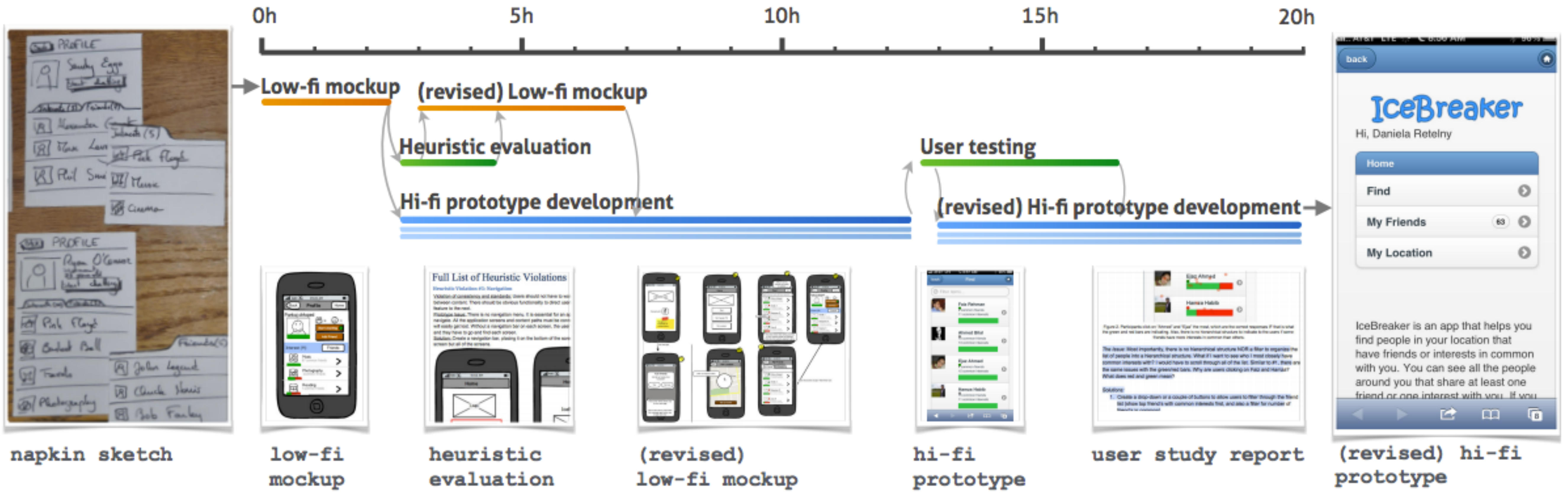


Figure 1: A flash team is a linked set of modular tasks that draw upon paid experts from the crowd, often three to six at a time, on demand. The napkin sketch design team follows the user-centered design process to create a series of prototypes and iterate based on feedback to produce a user-tested software prototype within a day. Multiple arrows indicate the beginning and end of pipelining; lighter bars indicate possible elastic growth.

https://www.youtube.com/watch?v=lVgTZEpHOzc

Daniela Retelny, Sebastien Robaszkiewicz, Alexandra To, Walter Lasecki, Jay Patel, Negar Rahmati, Tulsee Doshi, Melissa Valentine, Michael Bernstein. Expert Crowdsourcing with Flash Teams. UIST 2014: ACM Symposium on User Interface Software and Technology.