

# Ethics of Canary Testing: Users as Guinea pigs

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## 1 Introduction

Canary testing or Canary release is a method of software deployment where a new version or feature is rolled out gradually to users and evaluated over time to mitigate negative effects and/or bugs. Canary testing targets specific user groups and can thus be very powerful in optimizing software for targeted demographics and user groups. When developers are presented with the ability to target things toward specific users certain ethical concerns present themselves and developers may run the risk of engaging in ethically questionable practices. User experience may be negatively impacted due to rapidly changing layouts and functionality of the software to analyze and maximize company profits, retention and engagement. By keeping testing practices transparent with users to keep the team accountable for their testing practices along with trying to make sure the interests of the users are kept in mind and prioritized and giving users the autonomy of opting in or out of these Canary tests, developers can mitigate the risks of ethically questionable practices while still utilizing the flexibility and power of canary testing.

## 2 What is Canary Testing

Canary testing is a method used to release, test and evaluate new versions of software or a service in the field of Software Engineering. The name Canary testing comes from coal miners historically bringing Canary birds with them down into the coal mines in cages. The birds acted as early warning signs for the miners and if the canary birds died they knew it was a sign that lethal gasses were too high and that it was time to evacuate and leave the mines. [3] Similarly in software testing, Canary tests are used to prevent large scale catastrophes and complete system failures when rolling out new updates.

The idea behind Canary testing is similar to Rolling deployment where specific servers in the live production environment are given a new update and the results of the new update are evaluated and gradually rolled out to more nodes in the server network if results seem to indicate an improvement or that it works. But with Canary testing instead of deploying the update to specific servers, the new updates are instead rolled out to specific subset of users of the application. User metrics of this user subset are then analyzed and if these metrics indicate that the update is working or if it points towards an improvement then the new update continues to roll to a larger subset of users with the goal of it eventually reaching all users [4]. For a visual representation of the gradual deployment see Figure 1.

An example of how a Canary test could work is by developers using a thing called feature flags, which are essentially a Boolean value that developers can conditionally enable based on some condition that will enable specific code to users with the given feature flag enabled.

An example of how developers could use Canary testing is by using something called feature flags. A feature flag is simply a Boolean value that if set to true would enable the application to use a new feature in a hypothetical app, and developers could set this to only be enabled for users who live in a certain geographic location, or the flag could be enabled based on user age or other personally identifiable information that may make those specific users desirable to test the new features on. These flags along with the new code would be put into the production environment and live build of the app and user metrics would indicate which flags a user has enabled to differentiate between different users [3].

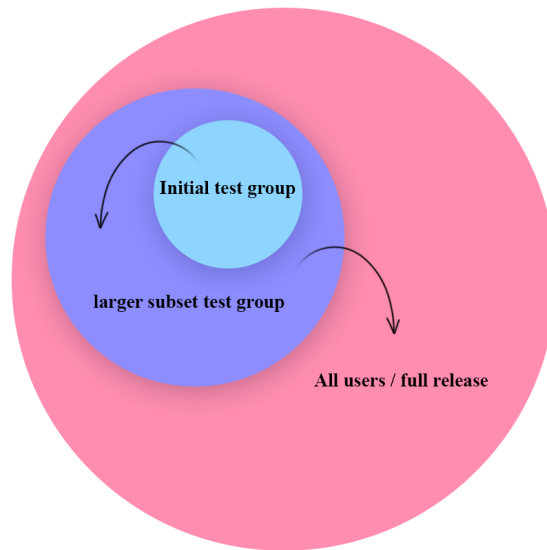


Figure 1: Gradual deployment to users with Canary testing

### 3 Benefits of Canary Testing

By using Canary testing with a Gradual deployment of new updates developers can mitigate the risks of colossal total system failure and minimize damage of uncaught errors. There are different ways of gradually rolling out new updates other than Canary testing such as Rolling Deployment and Blue/Green deployment [4].

Canary testing allows developers to gradually roll out and evaluate updates and or new features of a service to a small subset of the user group. Compared to Rolling Deployment developers can target these new test builds to specific sub-groups of users.

By doing this developers can test out the update in a live production environment and get real user test data while not risking the entire service going down. Targeting specific user groups can also have certain benefits over Rolling deployment since developers have control over which users that will get a certain update. Developers can deploy new test builds with certain features that they think may be useful for a certain subset of users that are more likely to interact with a given new feature and thus get more test data per user.

This concept of target group evaluation can be extended even further to optimize and compare how changes of an update effects different target demographics, and through this gained knowledge optimize the app to adapt and better suit each users needs and preferences. Any deployment method that allows developers to target tests to specific subgroups can be a powerful tool for user experience or behavioural optimization especially in cases where users are unaware that they are being tested on, a so called one-sided blind test [2].

### 4 Potential Ethical Concerns

One of the core ethical risks when running Canary tests are what is also considered one of the big benefits of Canary testing. What differentiates Canary testing from other gradual deployment methods is its focus on rolling out updates to specific users. If developers are not careful in how they utilize this power they may run the risk of engaging in ethically dubious practices. Many of these ethical concerns can apply to other deployment methods, especially those that are less transparent to users and those that can target specific users.

As Helena Jeret-Mäe writes in her article *The 10 Commandments for ethical software testers* [?], it's very important to know which interests your testing serves. With this power of targeting user

groups, developers may run the risk of potentially running tests on users that does not serve the interest of the user. With the ability to target and test releases on specific groups, investors and stakeholders in a service may push developers to experiment with features that target certain demographics to optimize profits, retention and or other metrics. While Canary testing can be used to improve the user experience and to quickly roll out updates while mitigating potential damage, it also has the potential to be used in an ethically bad manner against the interests of the users by analyzing specific target demographic user data with the intent of manipulating user behavior to further company goals. It is this focus on specific users and performance metric that can be used for both good and bad, it's one of it's strengths but also something developers must be weary of.

An example of how this user targeted tested can be used for morally bad practices is to single out and find users with behaviour and tendencies linked to being prone to gambling addictions and then with these users test slight variations of micro-transaction gambling features in games or other services, and through metrics steer the app, not in the direction that most users would enjoy but towards a path where as many gambling prone users as possible spend as much money as possible.

Having an easy way of testing software without risking widespread failure may lead developers down a path of not caring as much about feature quality or the frequency of bugs. It can be seen as an moral obligation by developers to ensure that a paying customer of a given service can use said service. Developers may be rolling out a new test version to users without properly evaluating the changes in the service, how the update may affect the users, their ability to use the service and the reason behind the test. It's the users that will be affected when performing Canary tests and they are the ones running the risk of running into issues when a new update rolls out. Users may be able to stand behind and accept running into potential bugs and changes with a service if they feel like it is done for the betterment of their experience and their long term benefit. But if users view a test or a new feature test as mostly or only being done in the self-interest of the company it may at best create resentment and negative views towards the company and at worst may be seen as ethically dubious or wrong by the user base.

Rolling out updates to a subset of users, if not done carefully. Can give viewers a sense of loss of autonomy, especially in the case of a paid service or licensed product where a certain level of quality is expected. When customers pay for a service they expect it to work and for it to be stable. If users are not aware that they are being experimented on they may get frustrated when they realize that their version looks or behaves differently from their peers' versions or from what they find written about the service on the internet. Rolling out tests to users without their knowledge has the potential to harm their ability to utilize a tool that they've paid for. A lack of transparency in how these tests are performed and how the user base is being used may lead to user mistrust and negative brand view.

## 5 Possible Mitigations

When engaging in Canary Testing it is important to always evaluate how the tests are being performed. One way of making sure that one's Canary tests are ethically sound and does not aim to manipulate users is to evaluate who's interests the tests actually serve. Does it benefit stakeholders and investors by manipulating user behaviour or does the test provide a new feature set that may aid in improving user work efficiency and well being? This can be done by correlating each of the new things that are being tested to company profits, users or maybe both. Most companies are for-profit organisations and have the goal of making money. But if a test seems to be too heavily weighted towards serving the companies interest without giving much of any benefit to the user base, then maybe rolling out Canary tests isn't the right solution.

Developers may not always be in a position where they have control over how Canary tests are being used. They may be forced by upper management to do or perform certain test practices that may be viewed as ethically dubious. In such cases, developers can create frameworks to evaluate tests before deployment. These frameworks can have user benefits be considered and weighed against the possible user experience impact. By making sure to minimize user impact when engaging in test that does not

serve their interest it is possible to mitigate possible negative reactions from users. If a new version ready for canary testing is considered to be in a risk zone or potentially not beneficial for users or that it risks impacting their experience negatively while not serving their interest, then adjusting the test version may be in order or it may be good to suggest another way of evaluating the new features to avoid engaging in ethically questionable practices.

Another way of mitigating risks of negatively impacting user relations is to give the user base some autonomy in their participation of the Canary tests. Developers can incentivise users to participate in testing by allowing them to opt into special pre-release builds specifically for testing. An example of users having autonomy in their participation in Canary tests can be found in how 343 Industries, the developers in charge of the game franchise Halo, has an opt in play-testing option for players to test out new things with the knowledge of it possibly having bugs and issues called "The Halo Insider Program"[1]. Having an inner circle of testers which is opt-in allows users to have the option to opt-in or opt-out of testing new features. It allows users to evaluate if it's worth the risk of bugs to gain access to new features faster. Some power user may find it worth it while some more casual users may not have a desire to get the newest things as fast as possible and values a stable experience higher. By lending users some autonomy they will feel more in control over their experience and if a user participating a Canary test runs into issues they will have the autonomy of opting out.

It can also be a good practice to be transparent about the tests and the metrics used in the Canary tests, that way developers can be scrutinized and held accountable for their testing practices by their users and if some practices are ethically questionable the pressure from a user base may be helpful if developers wish to change things in their testing practices when discussing it with upper management.

Alternatively one could introduce the ability for users to opt out of canary tests rather than to opt-in. A key aspect in making ethically sound Canary tests is to give users some agency. If users are negatively affected by a test that they have no control over, they will likely project their frustration towards the company, provider and or developers of the service. It's important to make the users feel like they are in control of their user experience and if they feel like they are negatively impacted by canary tests they have the ability to opt out. Prioritizing user agency means that users can do something about their frustration if they do not approve of a company's testing, practices or how they are affected by it and thus instead of projecting their negative feelings towards the developers they can do something about it.

## 6 Conclusion

Canary testing allows developers to quickly iterate and test new features without effecting the entire user base. But With the power of targeted testing on sub groups of users developers run the risk of engaging in ethically questionable practices if Canary testing is not approached and handled with caution. There are three main things developers can do to try and run ethically sound Canary tests:

- Evaluate who's interests that the test serves and how the tests can effect the users.
- Be transparent about how the tests are carried out and what methods and metrics that are used to evaluate the tests.
- Give users the autonomy to opt in or out of testing.

If not careful Canary tests can be used to prey on user behavioural analysis to optimize for profit, retention and engagement due to the user centered nature of canary testing. Developers must make efforts to evaluate who's interests that a tests serves and how it may effects it's users.

Even the best developers can sometimes make bad decisions and not realize that they might be using users in a ethically bad way. Developers should make efforts to disclose how they run their tests and what metrics are evaluated to keep themselves accountable by the users in case they are blinded from their own actions. And developers should prioritize user agency in their choice of participation in Canary tests. Doing all of these things will aid developers in creating ethically sound Canary tests and allow developers to avoid engaging in ethically dubious practices when utilizing the power of Canary testing.

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