

# Exhibit 221

From: [REDACTED]  
To: [REDACTED]  
Sent: Wed, 9 May 2018 10:13:29 -0700  
Subject: [REDACTED]

Cc: [REDACTED]

The PA Lead, PM & Eng bits are flipped. The Monitoring Holdback project status with 1 month meeting date is set. Thanks!

On Wed, May 9, 2018 at 10:04 AM, [REDACTED] wrote:

Lets make it a top priority to [REDACTED]  
[REDACTED] can you nominate someone in your team to help out?

On Wed, May 9, 2018 at 10:03 AM, [REDACTED] wrote:

Given the urgency of the GDPR, the big loss of [REDACTED] if we don't launch this change [REDACTED]  
[REDACTED]  
I am fine going ahead with this launch. Drop in [REDACTED] is small which shows  
location accuracy is not too bad.  
But we should definitely have a hold back [REDACTED]  
[REDACTED]  
A drop in low priority makes sense (as we have a limited number of low priority notifications).  
But it doesn't make sense for passive,  
as those should not compete for each other.

[REDACTED]

As a side note, I would like to understand better why we stopped using [REDACTED] a few months ago? Were folks aware we dropped it?  
And was there a launch report? Or it was bug and nobody noticed it until now?

On Wed, May 9, 2018 at 9:44 AM, [REDACTED] wrote:

[REDACTED] sorry about any confusion, there are two arms that could be considered as "control"

[REDACTED]

"compared to current production" means [REDACTED] "compared to GDPR change" means [REDACTED]

[REDACTED]

On Wed, May 9, 2018 at 8:22 AM, [REDACTED] wrote:

On Thu, May 10, 2018 at 12:11 AM [REDACTED] wrote:

[REDACTED] you wrote:

[REDACTED]

What I meant was that this change is going to go out with the GDPR change (it will have to be the default in a month's time). The result of the GDPR change is that we will have significantly fewer location updates and that by itself will be reducing overall refreshes. The [REDACTED] integration (this launch) won't regain these because [REDACTED] locations are not considered valid for geo fencing. I was just pointing out that given that reduction in refreshes we would naturally see fewer passive notifications that rely on these refreshes.

I am not sure I get that. With GDPR change already enabled in control, why is there a reduction on the number of location updates?

As for LOW\_PRIORITY, having more weather would mean fewer At-a-Place. The fix for that is supposed targeting C2D or clicks-per-display-hour for ranking low-priority notifications (At-a-Place is short-lived). I believe this is on Randy's roadmap.

On Wed, May 9, 2018 at 8:03 AM, [REDACTED] wrote:

I want to clarify the [REDACTED] impact statement:

[REDACTED] +3.2% compared to current production, +8.4% compared to GDPR change

Are the above using different controls? I.e. is "+3.2% compared to current production" assuming the GDPR change in experiment, or using assuming production setup in experiment? That is -- when this launches with the GDPR change, will we actually see a total [REDACTED] gain, or will it still be a partial loss?

When this launches with the GDPR change we will see a total [REDACTED] gain even compared to today before the GDPR change.

On Tue, May 8, 2018 at 11:45 PM, [REDACTED]

[REDACTED] wrote:

Thanks for providing details [REDACTED]

On Wed, May 9, 2018 at 2:35 PM [REDACTED] wrote:

On Tue, May 8, 2018 at 9:10 PM, [REDACTED] wrote:

A few quick questions about the launch:

- Will this impact only LH-off users, or will it also impact LH-on users?

i think this will impact LH-on users also. Eg, a user can have LH-on but have the GPS turned off, in which case we will fall back to using [REDACTED] (using cell tower data).

- Do we have precision numbers for [REDACTED] 5km? How frequently is the location completely off?

[REDACTED] team for more stats.

As per this [dashboard](#) the [REDACTED] AGSA non-LH user city accuracy is 80 % for US and ~65% for IN. This change will result in us getting more complains about weather location being wrong even though we dont see a drop in iHNR.

It's true that with this we'll end up having less accurate location for some users, most

especially for users who had LH off and are now being forced to have [REDACTED] location instead of more accurate locations via background refreshes. Hopefully this can accuracy can be improved by the separate efforts for providing coarse grained location for these users, as described in step 2 of [this doc](#) and detailed in [this PRD](#).

An additional option we can consider to experiment with post-launch is the use of [REDACTED] confidence before using the [REDACTED] supplied location value. Right now we don't specify it so we're using the default confidence that's used by rest of Search. We did consider having separate arms to experiment with different confidence levels but we already had several arms in the experiment and wanted to have a simple initial integration with [REDACTED] and focus on getting this out as soon as we could.

- I guess we didn't have time to run GCS for the notifications?

No. Crust is currently not supporting notifications. Also, note that a few years ago we had already approved and launched the use of [REDACTED] for weather low priority notifications but then it broke as part of the migration. To some extent this change is fixing it.

- Do we have any hypothesis of why other notifications are dropping? Specially the soccer, music album and webkick ones (others are less impacted)? Are the drops only for low-priority notifications or also for passive? whats the breakdown?

There are many in [this doc](#) but we will need more time to narrow down. The drops are for passive notifications also.

Loss in low priority notifications (excluding weather) [REDACTED]

Loss in passive notifications (excluding weather) [REDACTED]

The drops for low priority make sense because there's a limit to the number of low priority notifications we include and thus sending more weather (low-priority) notifications could affect the number of non-weather low-priority we see.

It also makes sense to have some drop in passive because reducing the number of location updates will reduce overall refreshes and thus impact passive notifications relying on refresh.

What still needs further investigation is why there's a discrepancy for a drop in notifications with and without [REDACTED] integration. Agreed with [REDACTED] suggestion to have a separate holdback to better understand what's going on.

On Tue, May 8, 2018 at 6:10 PM [REDACTED] wrote:

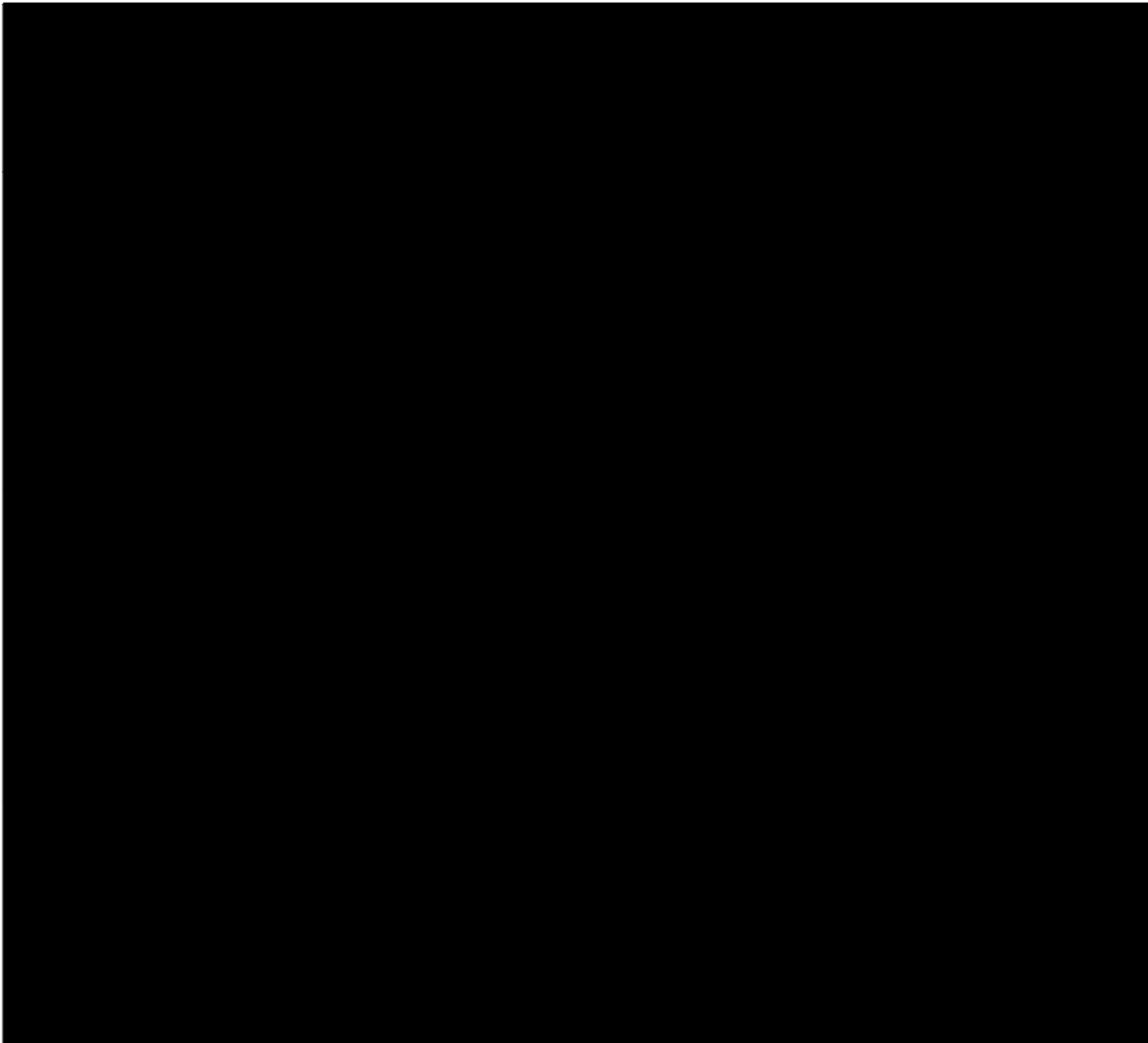
[REDACTED]  
Since there are some unexplained loss of non-Weather notifications in this proposed launch here is a potential launch plan that we discussed with [REDACTED] (subject to this launch approval)

- 1) Start ramping up (GDPR + [REDACTED] this week and into next week
- 2) Setup a long running holdback (GDPR change Vs GDPR change [REDACTED] which we use for debugging going forward. This way we will be compliant and will have the ability to keep debugging.

On Tue, May 8, 2018 at 5:23 PM [REDACTED] wrote:

Had a typo in the experiment set up table, please see correction below





On Tue, May 8, 2018 at 2:37 PM, [REDACTED] wrote:

[REDACTED]  
[REDACTED]  
[REDACTED] Bits pending review: PM, PA Lead, Eng [REDACTED]

Hi Quality Leads,

Above is the link to the completed FastTrack report. I have also pasted the report in full below.

Enable [REDACTED]nferred user location in  
[REDACTED]

- [Enable \[redacted\] inferred user location in \[redacted\]](#)
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## Eval Information

Eng/TL: [redacted]

PM: [redacted]

Analyst: [redacted]

Experiment type(s):

- Live Traffic Experiments [redacted] with control = production [redacted] with control = GDPR change [redacted] (NOT being sent for LH-off users)

For more details on the launch status, please visit the launchtool entry at [redacted]

### Overview

This launch enables [redacted] inferred location in [redacted] so it makes Now weather cards and notifications available for users who turned off LH(location history). Basically this launch enables weather card notifications for those users, but this inferred location may be used for other cards/notifications using user location as well.

Related information [redacted] IPGeo based weather cards and notification was launched in 2016 (Due to Now/Search unification 8/22 2016, the feature is effectively unlaunched. [redacted] There was a try to launch [redacted] location last year, but it wasn't launched because of confounding LE results and it's deprioritized. In Q1 2018, with a GDPR change experiment, weather card and notifications lose ~30% impressions because the inferred location information is missing and it's urgent to make it available.

### Motivation

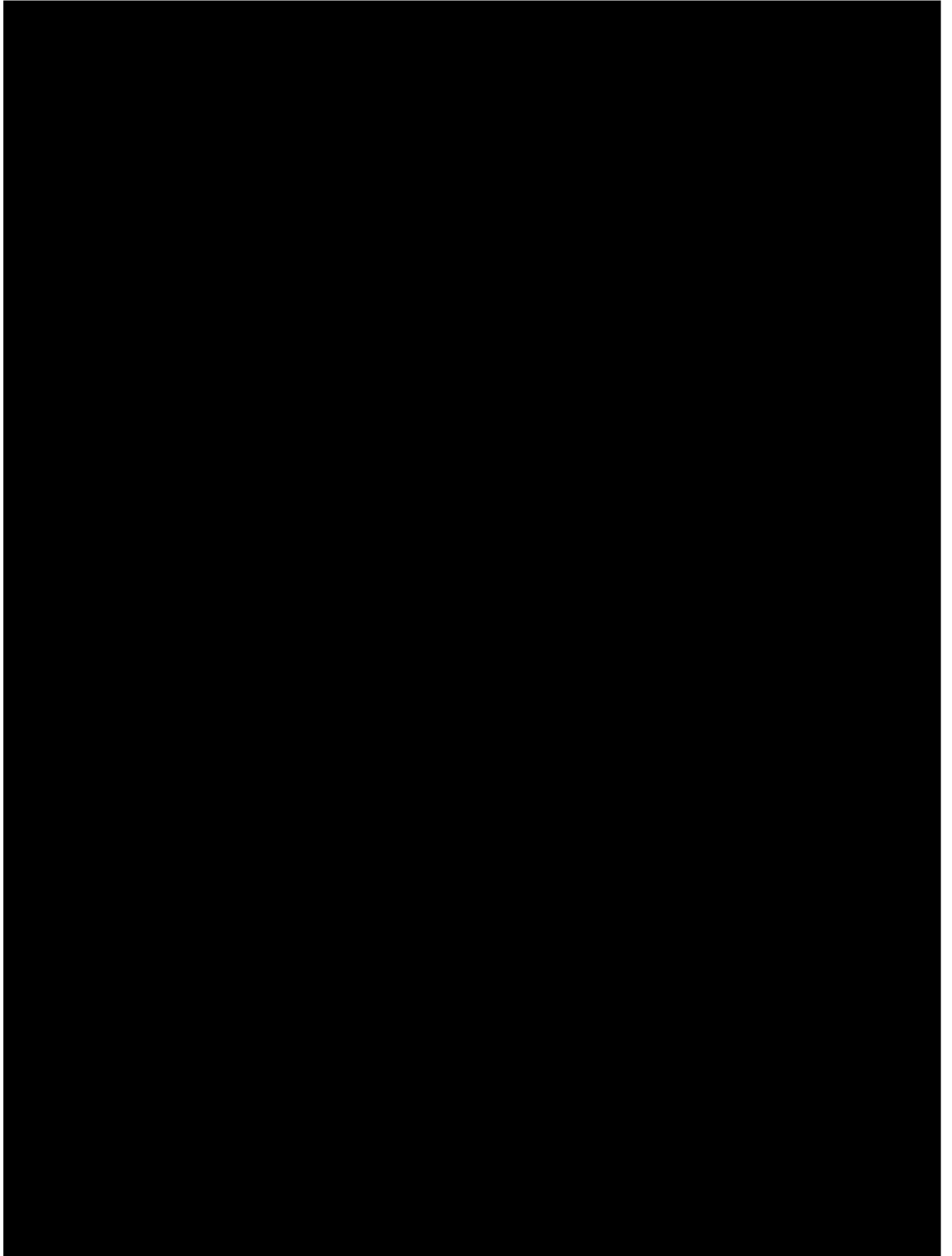
GDPR change will immediately make ~30% impressions loss for weather card and notifications without an alternative location information.

### Experiment Details

[redacted] with control = current production

[redacted] with control = GDPR change [redacted] (NOT being sent for LH-off users)







Note:

- In these experiments, weather notification click target is the same as production (as of 2018/05/08), i.e., going to SERP in en-\* in US, IN, ID, AU, CA, UK, pt-\* in BR, id-\* in ID, and going to Feed card in other locales. There's concurrent discussion about whether to change that.
- In the Analyst Recommendation section, metrics are summarized assuming that we take ExperimentWith [REDACTED] 5km as the launch candidate. See metrics for all arms in the metrics screenshot section.

## Project Impact

**Note: This experiment introduces a new location signal, thus increasing the weather notification impressions in a large amount: +17.39% compared to current production, +61.3% compared to GDPR change.**

As a result, we observe Interactive DAU +3.2% compared to current production, +8.4% compared to GDPR change.

It is currently unknown how this launch will interact with the weather notification backoff model ([launchcal](#)).

## Analyst Recommendation

### Live Traffic Analysis

Note: The summary below is assuming that we take [REDACTED] 5km as the launch candidate.

In Comparison to GDPR change (which has to launch in compliance with GDPR):

- Interactive DAU +8.4%
- Feed Interactive Users +4.1% (based on data since 5/4)
- Weather Notifications: overall, impressions +61.3%, CTR +11.3%, whereas iHNR -2.16% (63.9% → 62.5%). iHNR is down for both WEATHER\_DEFAULT\_NOTIF (63.2% → 61.8%) and WEATHER\_NEXT\_DAY\_DEGREE\_DELTA\_NOTIF (66.3% → 64.7%).
- CTR for weather notifications shows a strong novelty effect ([screenshot](#)).
- Non-weather notifications: impressions -5.7%, CTR +1.96%, iHNR +3.55%.
- Impression drop mainly comes from: AT\_A\_PLACE\_LOCATION -1.94%, SPORTS\_GAME\_SOCCER -8.84%, SPORTS\_VIDEO\_HIGHLIGHTS -5.19%, REGULAR -2.56%, WEBKICK\_EXPLICIT\_INTEREST -9.19%, KE\_NOW\_ARTIST\_TO\_ALBUM -25.84%

- Webkick cards: BooleanViews +0.42%, CTR +0.84%, LikeR +4.84%.

In Comparison to current production:

- Interactive DAU +3.2%
- Feed Interactive Users +1.58% (based on data since 5/4)

### **Metrics/Data Issues (Optional)**

### **Results**

### **Live Traffic Experiment Results**

Rasta with control = current production

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