

Architecting Cross-Platform Mobile Frameworks

Spencer Chan – Quora

Motivation

- Two extremes
 - Fully native
 - Fully HTML+JS
- How can we get the best of both worlds?

Motivation

- Two extremes:
 - Fully native
 - Fully HTML+JS
- How can we get the best of both worlds?
- For the last 3 years, Quora has used a custom hybrid framework
 - We're very happy with it

Agenda

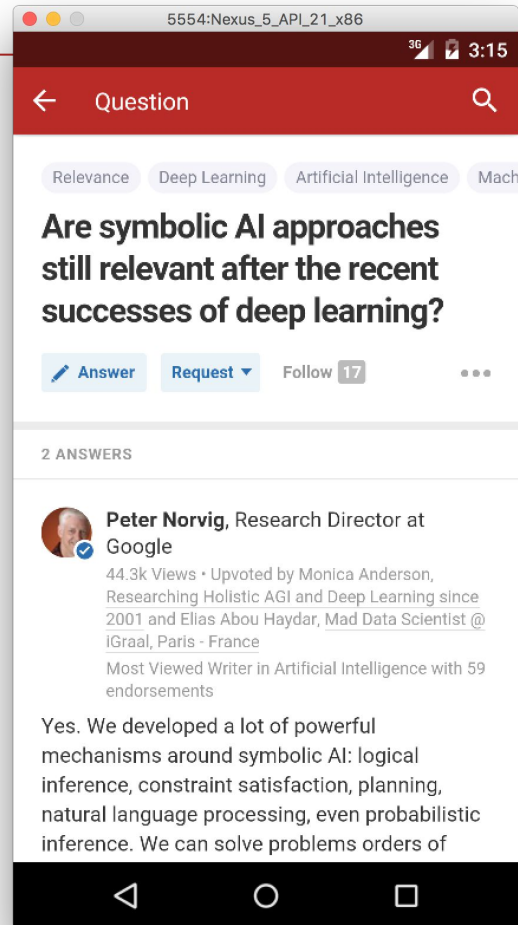
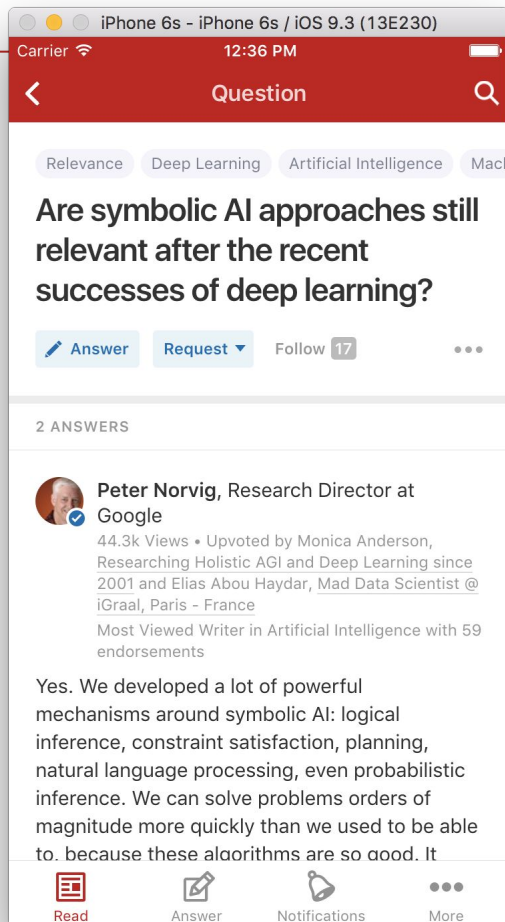
1. How Quora's app works
2. Design Decisions
3. Learnings from the past 3 years

Takeaways

- What can you expect if you follow the same path we did?
- Is this approach worth exploring for your apps?
- What should you look for in a publicly available framework?
 - Are you better off building your own?

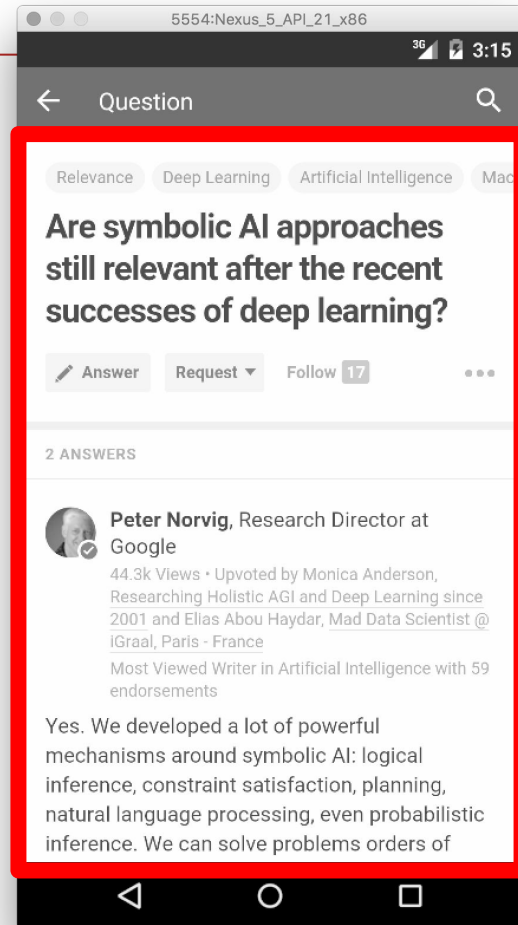
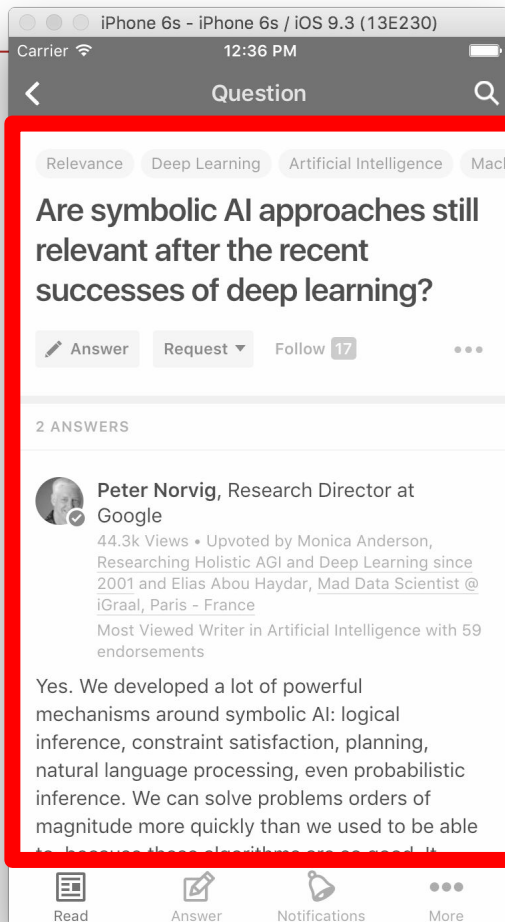
How it Works

This is a question page



This is a question page

Webviews
outlined
in red

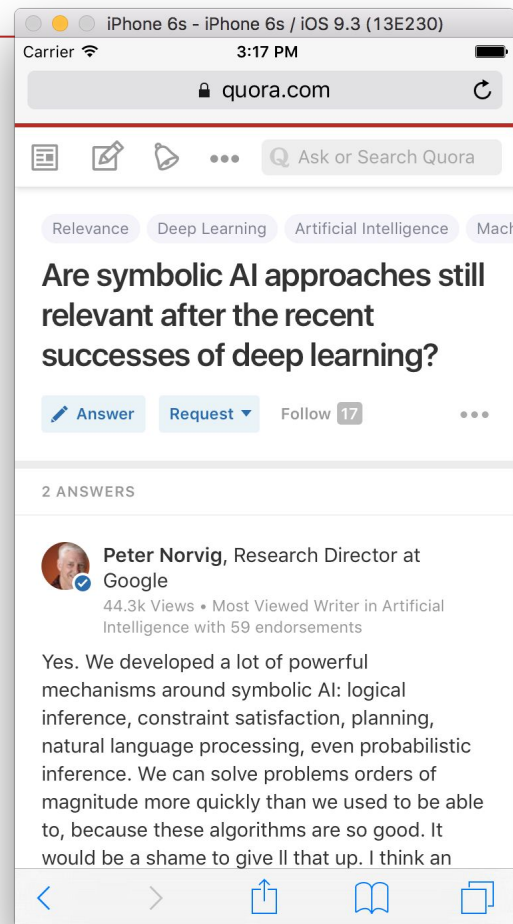
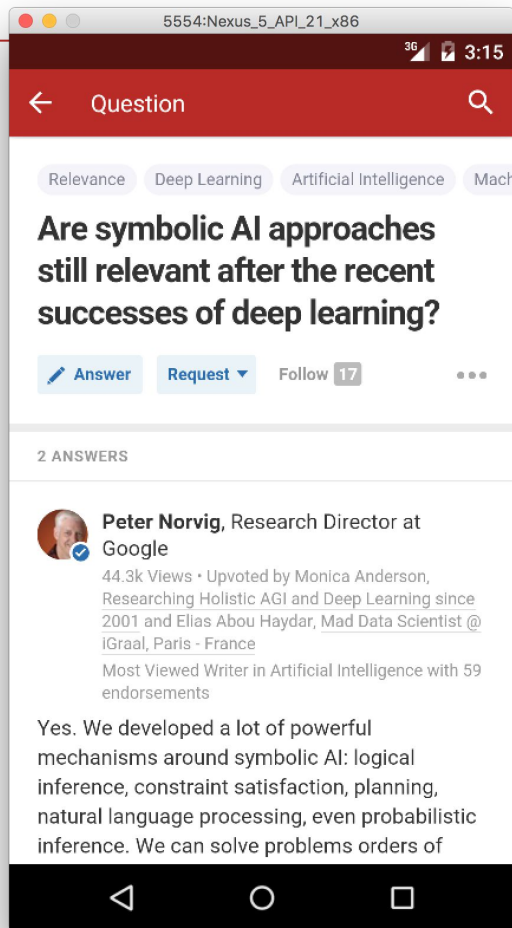
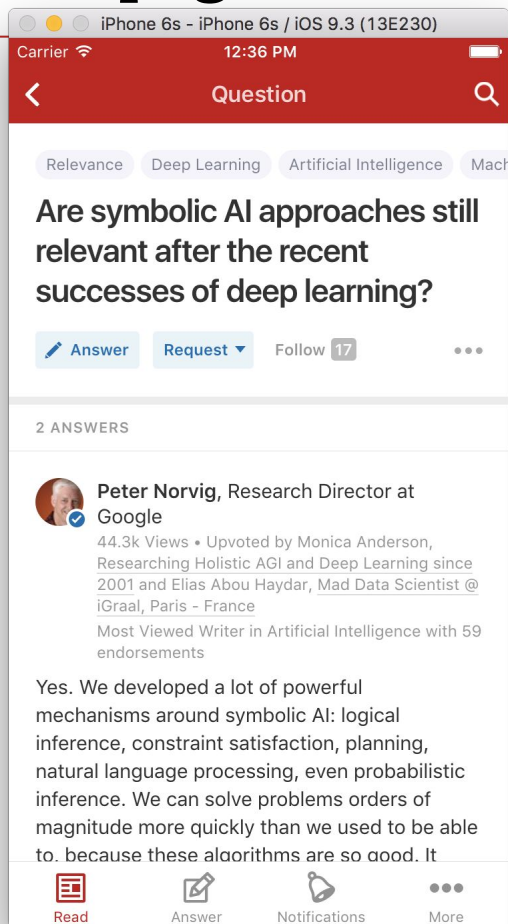


Meanwhile on the Server

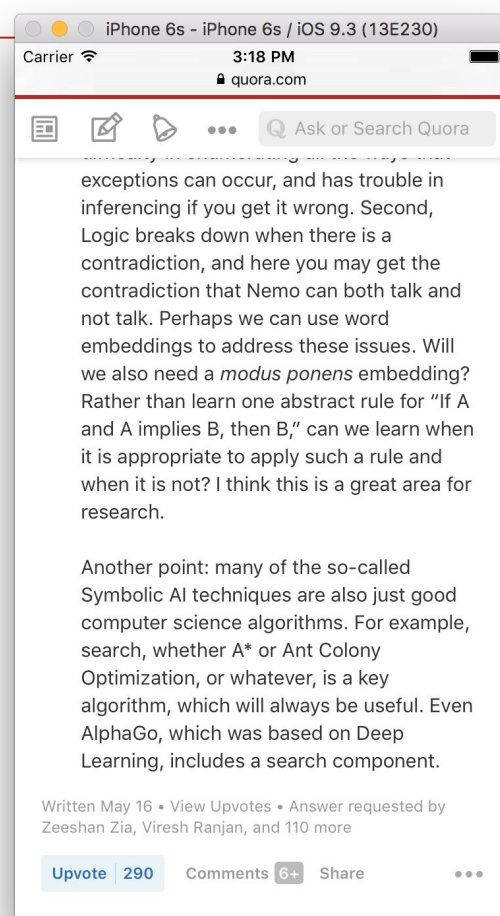
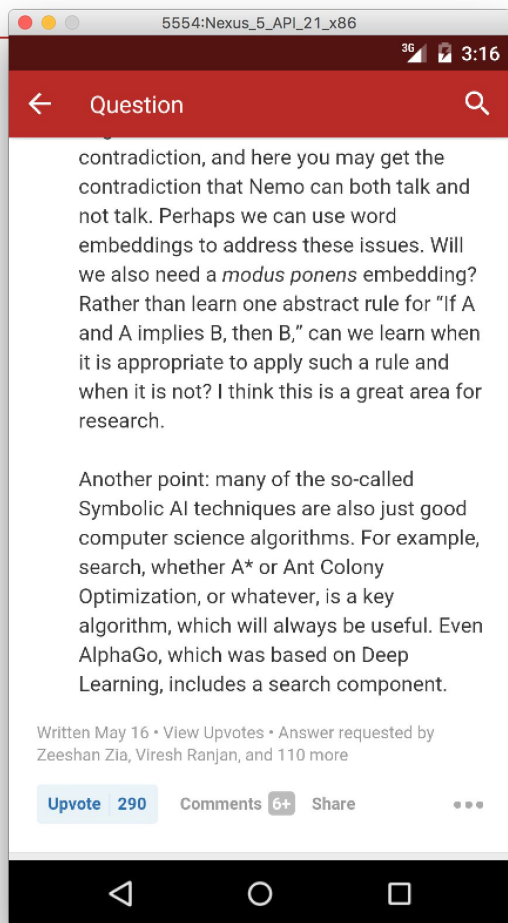
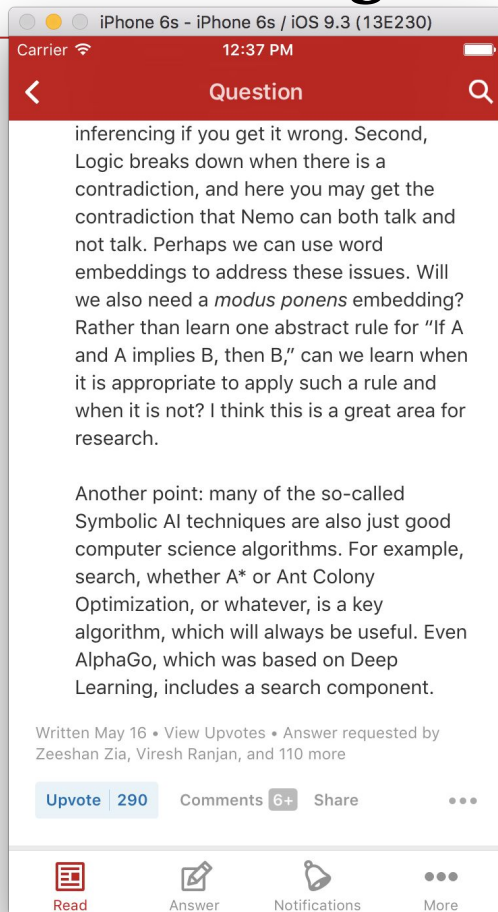
- The webview loads a url
- The page is rendered by a tree of component objects
- This component is used across all platforms

```
1 # view/button.py
2 class Upvote(Component):
3     def init(self, answer_id):
4         ...
5     def render_html(self):
6         ...
7     def on_press(self, user_id):
8         ...
```

After page load



After scrolling to the end of the answer



Pressing the button

HTML +
CSS

A light blue rectangular button with rounded corners. It contains the text "Upvote" in a dark blue font, followed by a vertical separator line and the number "290" in the same dark blue font.

Upvote | 290

Pressing the button

HTML +
CSS +
JS

Upvoted | 291

Pressing the button

HTML +
CSS +
JS

Upvoted | 291

No native code involved at all!


Now for a different example...

Here's a user profile page

iPhone 6s - iPhone 6s / iOS 9.3 (13E230)

Carrier 7:51 PM

< Hillary >

 **Hillary Clinton**
Senator, Secretary of State, 2016 presidential candidate



Wife, mom, grandma, women+kids advocate, FLOTUS, Senator, SecState, hair icon, pantsuit aficionado, presidential candidate.

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VIEWS ON HILLARY'S ANSWERS

12,138,193 ↑ Last 30 Days	22,018,988 All Time
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HIGHLIGHTS


-  **Published Writer**
Medical Daily, Time, and 9 more >
-  **Most Viewed Writer**
Politics of the United States of America, Politics, 2016 U.S. Presidential Election >

[Read](#) [Answer](#) [Notifications](#) [More](#)

5554:Nexus_5_APL21_x86

3G 8:04

< Hillary >

 **Hillary Clinton**
Senator, Secretary of State, 2016 presidential candidate



Wife, mom, grandma, women+kids advocate, FLOTUS, Senator, SecState, hair icon, pantsuit aficionado, presidential candidate.

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iPhone 6s - iPhone 6s / iOS 9.3 (13E230)

Carrier 7:50 PM

quora.com >

 **Hillary Clinton**
Senator, Secretary of State, 2016 presidential candidate



Wife, mom, grandma, women+kids advocate, FLOTUS, Senator, SecState, hair icon, pantsuit aficionado, presidential candidate.

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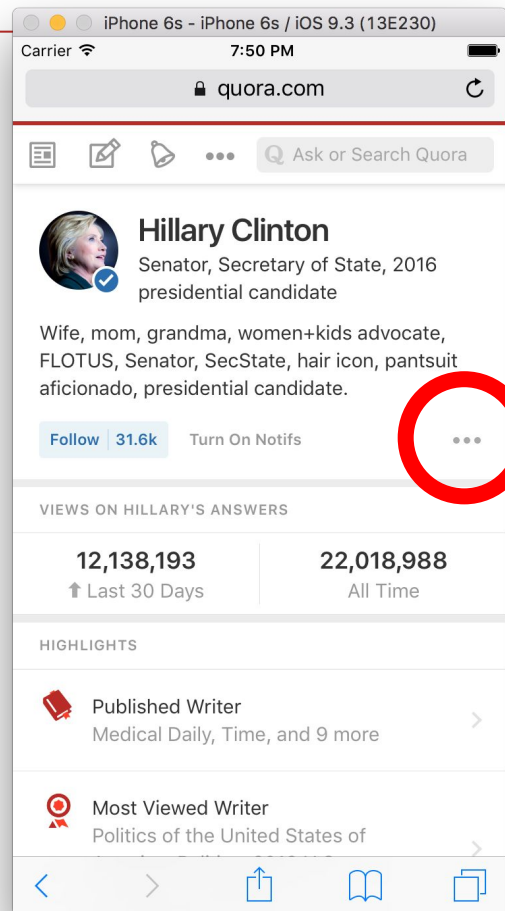
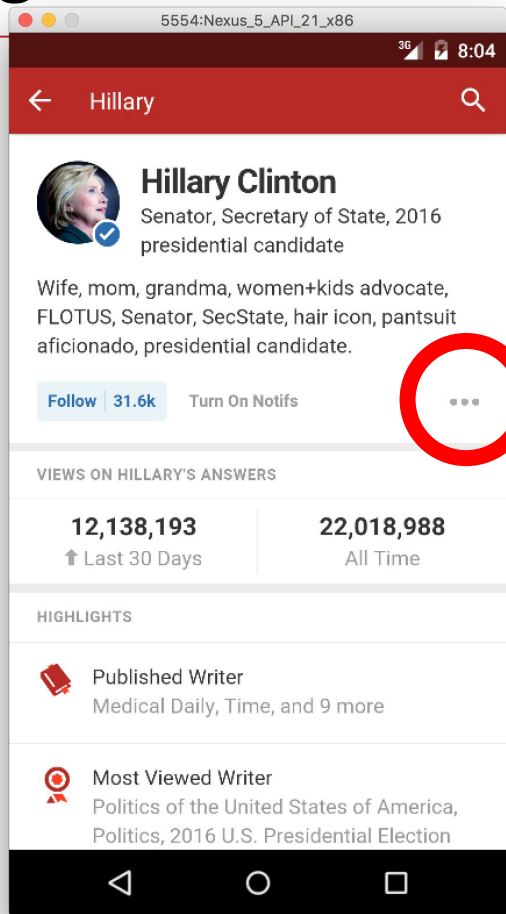
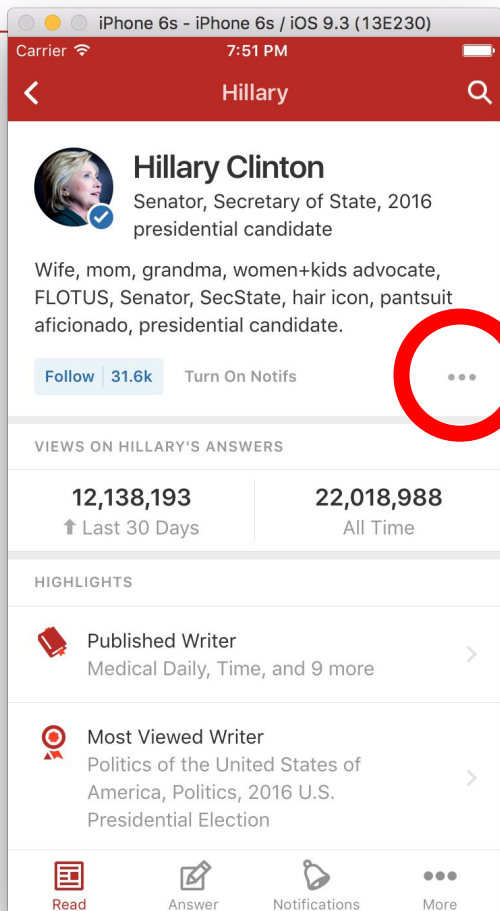
12,138,193 ↑ Last 30 Days	22,018,988 All Time
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HIGHLIGHTS

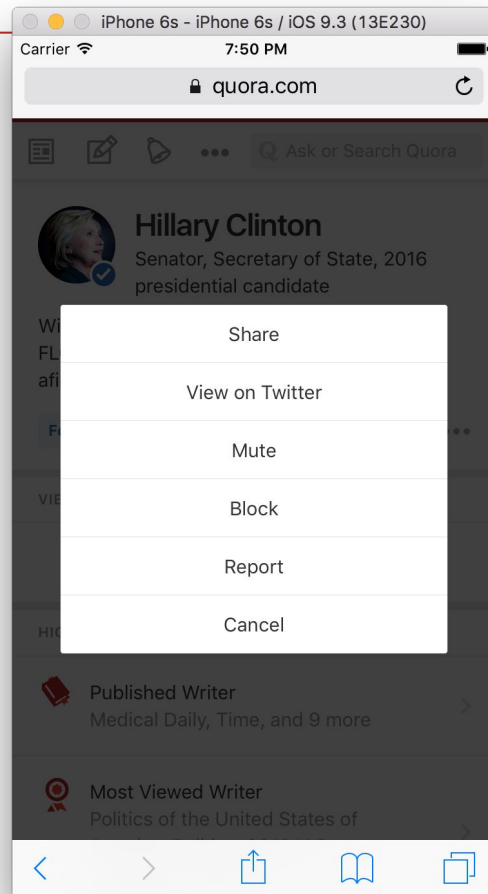
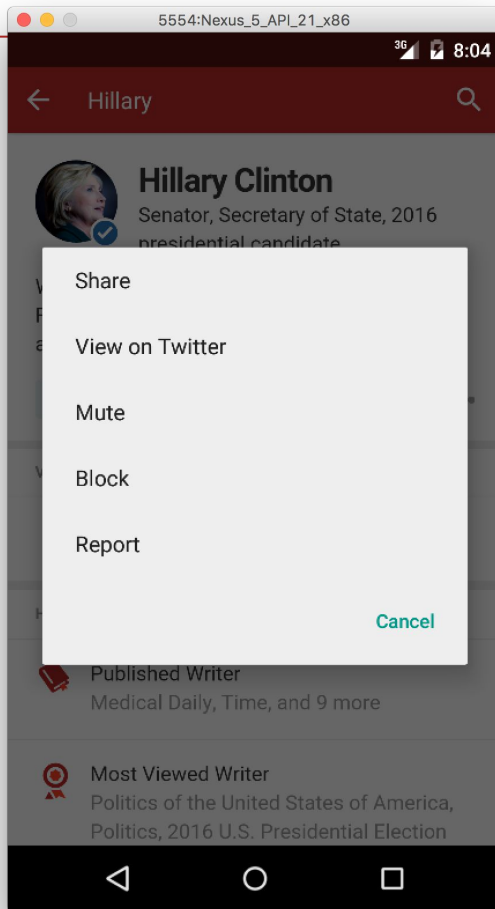
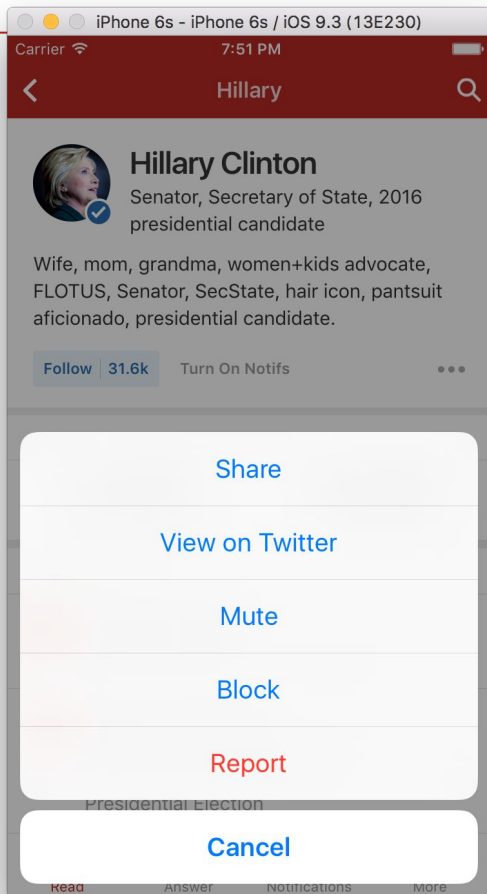
-  **Published Writer**
Medical Daily, Time, and 9 more >
-  **Most Viewed Writer**
Politics of the United States of >

< > [Share](#) [Bookmarks](#) [Tabs](#)

Tapping here is going to show a menu ...

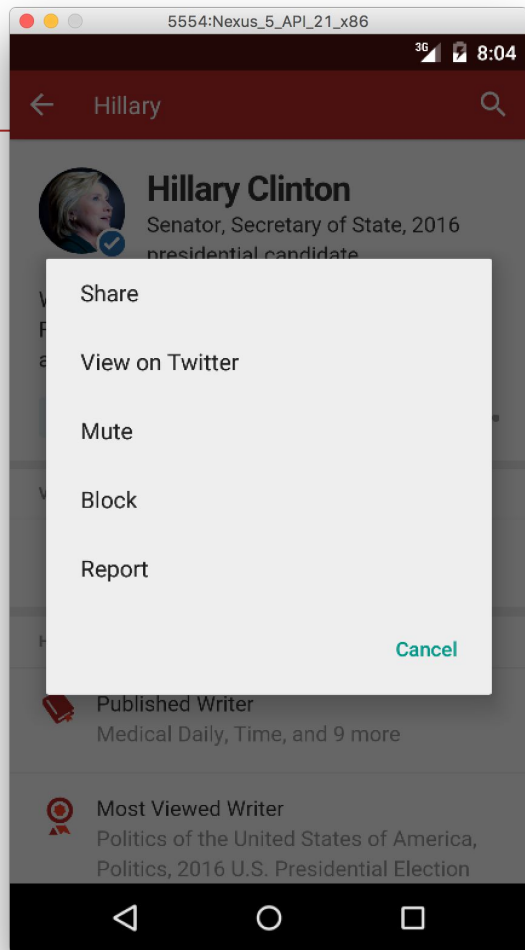


Native menu



Native menu

```
1 var options = [  
2     'Share',  
3     'View on Twitter',  
4     ...  
5 ];  
6 var callback = function(selection) {  
7     ...  
8 };  
9 native.showMenu(options, callback);
```



Message Passing

```
1  // the same code from last slide ...
2  native.showMenu(
3      ['Share', ... ], // option names
4      function(selection) { ... } // callback
5  );
6
7  // under the hood sends this message to native code
8  {
9      messageName: 'showMenu',
10     data: {
11         options: ['Share', ... ],
12         callbackId: 12345
13     }
14 }
```

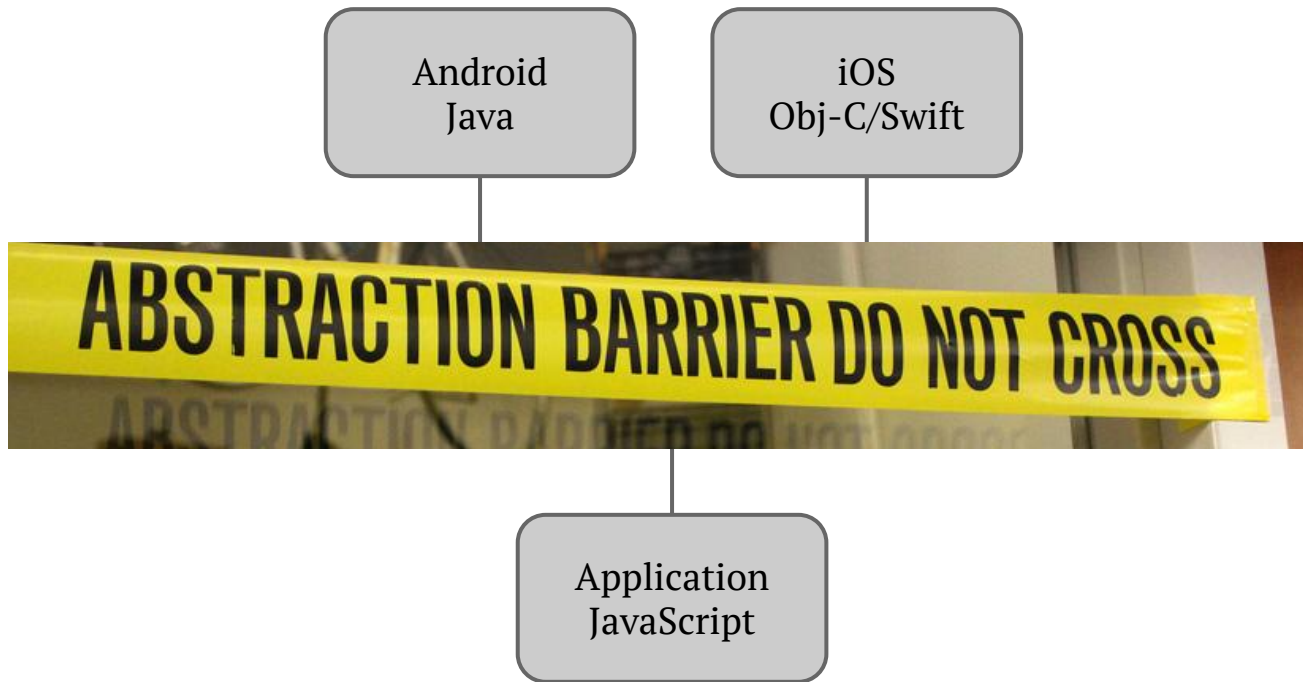
Message Passing

```
8  {
9      messageName: 'showMenu',
10     data: {
11         options: ['Share', ... ],
12         callbackId: 12345
13     }
14 }
15
16 // when the user selections the option at index 1,
17 // native code replies with the following
18 {
19     messageName: 'executeCallback',
20     data: {
21         callbackId: 12345,
22         arguments: [1] // index of selected option
23     }
24 }
```

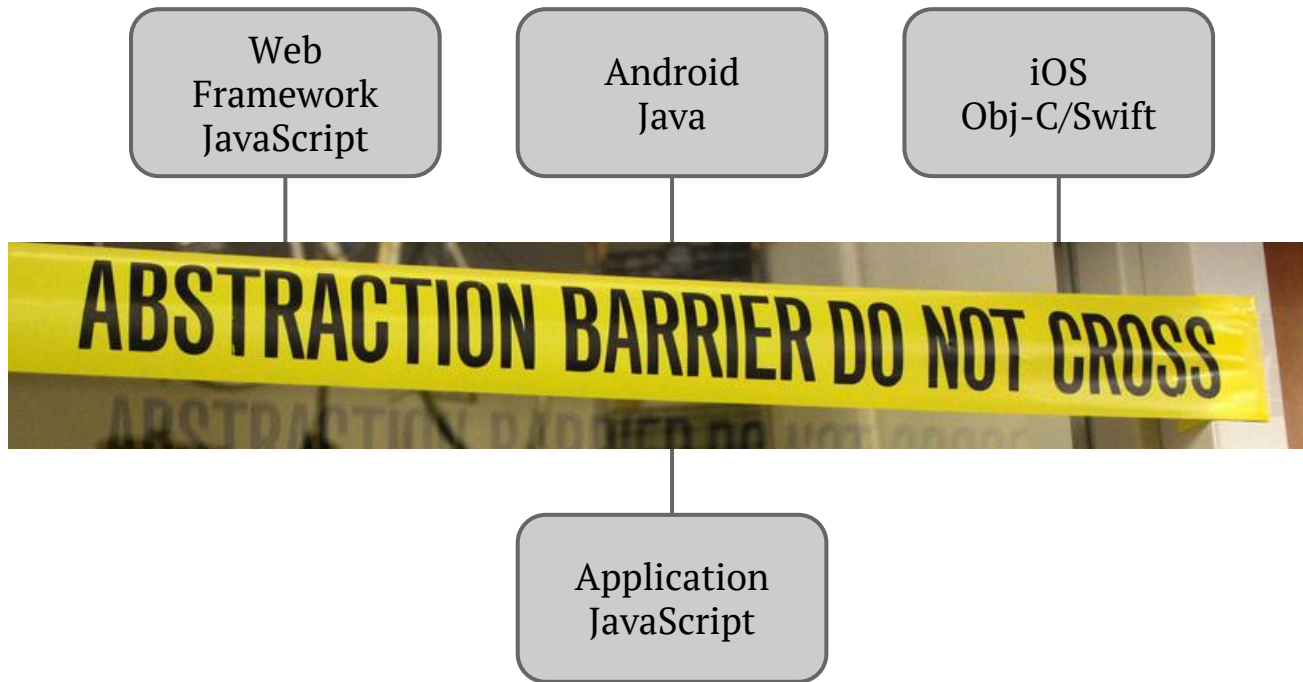
Message Passing

- Implemented differently for each platform
- Asynchronous message passing is more future proof
- Minimal, but can build on top of this

Abstraction is your friend



Abstraction is your friend



Abstraction is your friend

- Abstracting away platform specific code simplifies the remaining application code
- Also useful for cross-browser compatibility
 - This is one of the main benefits of things like jQuery

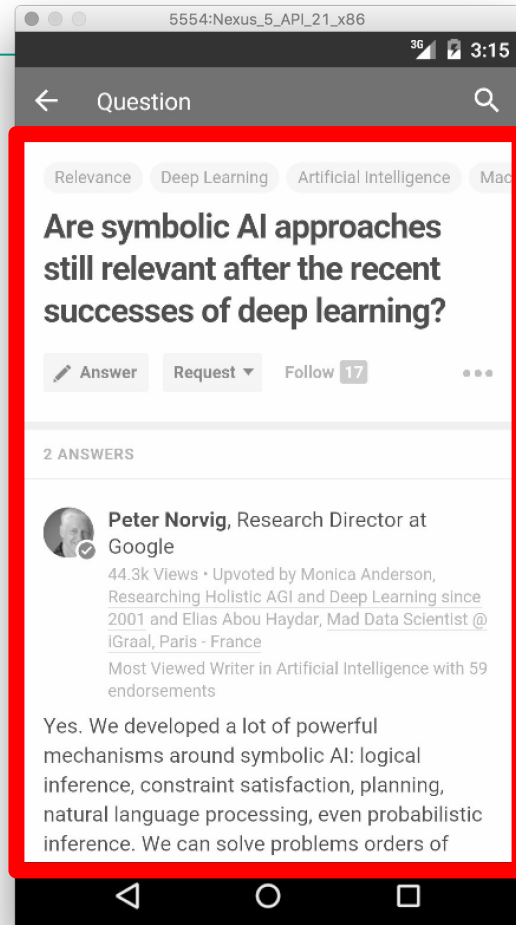
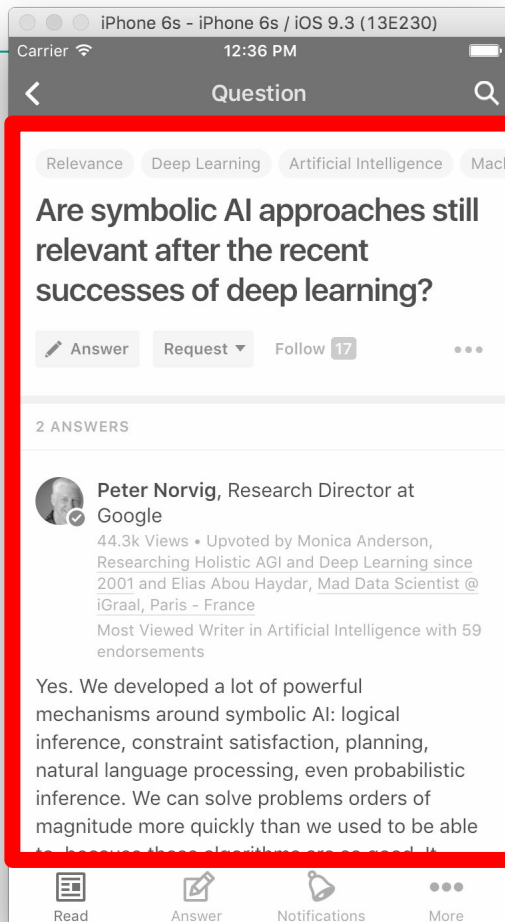
Design Decisions

Design Decisions

1. **HTML Content**
2. Native Navigation
3. No Page Types

HTML Content

Webviews
outlined
in red



HTML Content

HTML +
CSS +
JS

Upvoted | 291

No native code involved at all!

HTML Content

- Alternative: native views powered by shared application code
- HTML views increase potential code sharing with websites, if you have one
 - Client side vs. Server side rendering
- HTML is great for text-heavy products like Quora

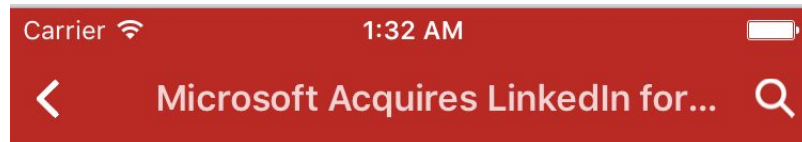
Design Decisions

1. HTML Content
2. **Native Navigation**
3. No Page Types

Native Navigation

- Each navigation creates a new webview and adds it to the native navigation stack.
- Pros
 - Native gestures
 - Native animations
- Cons
 - Makes prefetching harder
 - More native code, less code sharing

Native Navigation



Microsoft Acquires LinkedIn for \$26.2 Billion (June 2016)

"Microsoft and LinkedIn Corporation on Monday announced they have entered into a definitive agree... [More](#)

NEW STORIES

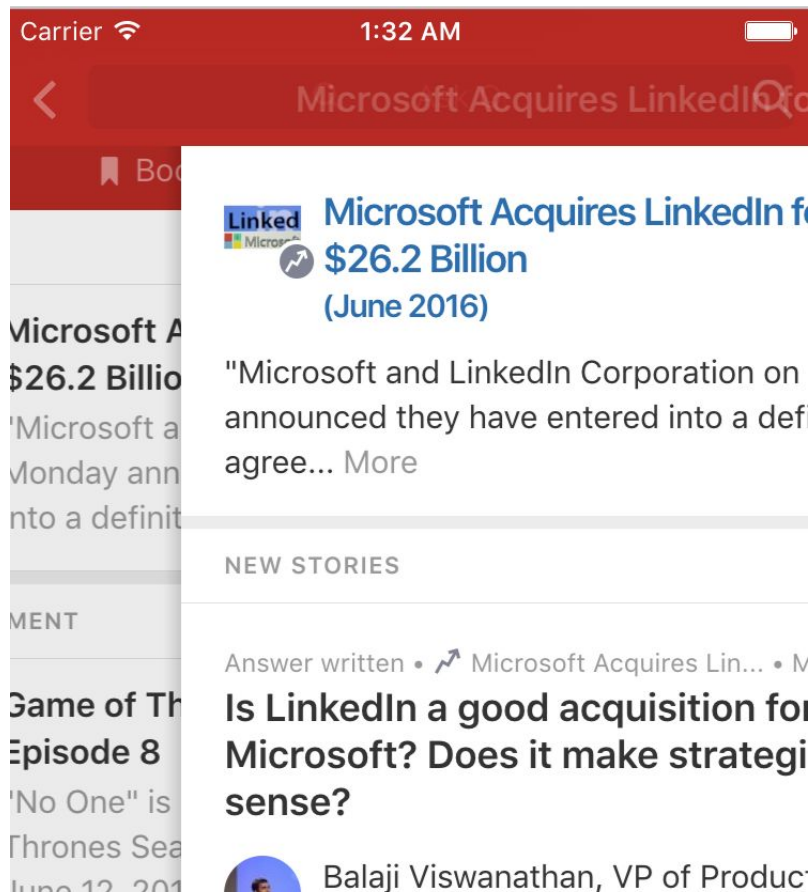
Answer written •  Microsoft Acquires Lin... • Mon

Is LinkedIn a good acquisition for Microsoft? Does it make strategic sense?

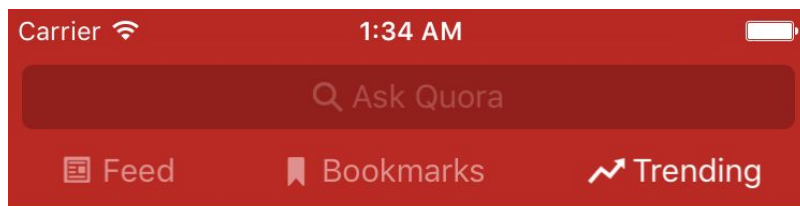


Balaji Viswanathan, VP of Products at

Native Navigation



Native Navigation



BUSINESS



Microsoft Acquires LinkedIn for \$26.2 Billion

"Microsoft and LinkedIn Corporation on Monday announced they have entered into a definitive agreement under..."

ENTERTAINMENT



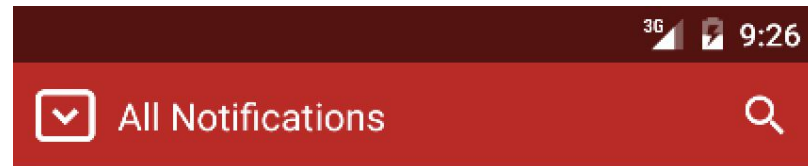
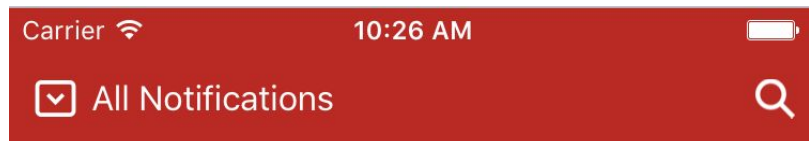
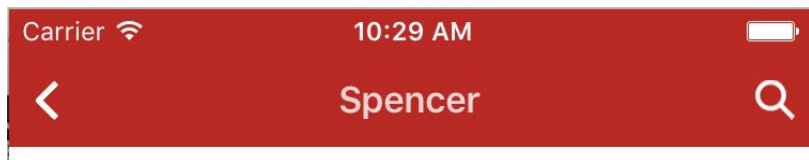
Game of Thrones Season 6 Episode 8

"No One" is Episode 8 of Game of Thrones Season 6. It will premier on June 12, 2016

Design Decisions

1. HTML Content
2. Native Navigation
3. **No Page Types**

Native UI Examples: How do we implement this?



Solution 1: Page Types

- "This is the notifications page"
 - Native code knows it should have certain buttons and styling

Solution 2: No Page Types

- "Native UI should have these buttons and this styling"
 - Native code doesn't need to know about notifications
- This makes it easier to maintain a strong abstraction barrier
- Useful if you expect to add or modify page types often

Avoid Message Thrash

- Backwards compatibility is painful
- Easier to do without page types, but still a concern
- Avoid UI thrash!

Design Decisions

1. HTML Content
2. Native Navigation
3. No Page Types

Learnings

Learnings

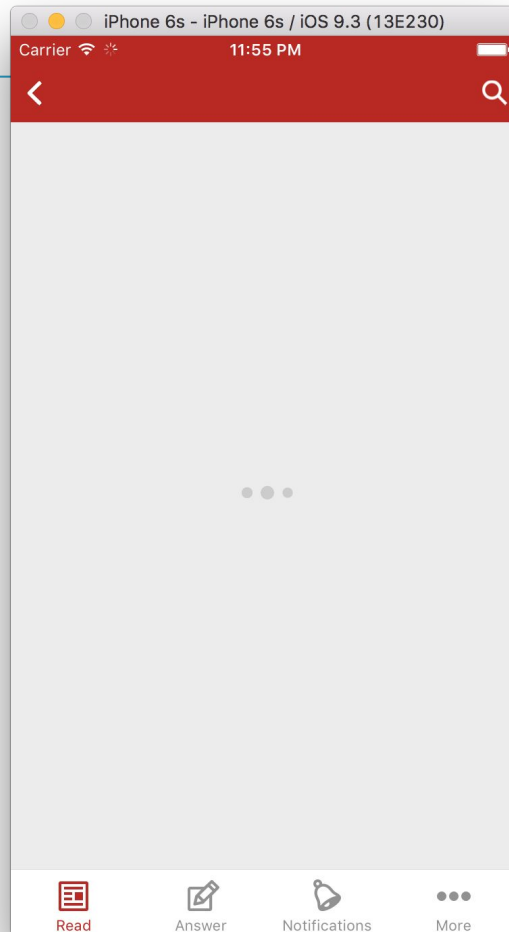
1. **Be prepared to deal with webview quirks**
2. Demystify loading slowness
3. Code sharing goes deeper than views
4. JavaScript lets everyone contribute

Webview Issues

- Problem:
 - Spike in crash reports saying app ran out of memory
- Solution:
 - It was a new image loader we were trying out
 - Don't load images in JS on that webview implementation

Webview Issues

Our webviews have an animated loading screen (the 3 dots in the middle are animated)



WebView Issues

- Problem:
 - We want to fade out the loading screen as soon as any content is visible in the webview
 - But we can't tell from native code when webview has started displaying content
- Solution:
 - Poll the webview pixel to see when they start changing

Learnings

1. Be prepared to deal with webview quirks
2. **Demystify loading slowness**
3. Code sharing goes deeper than views
4. JavaScript lets everyone contribute

Real issues caused by webviews

- Bandwidth
 - HTML is bigger than JSON
- Multiple roundtrips
 - Blocking on CSS/JS
 - Web performance could be the subject of a whole separate talk

Issues unrelated to webviews

- Latency
 - Loading images from a server on the other side of the world will be slower than loading them from a CDN
- Slow application code
 - Example: not paginating data
 - Again, this could be a whole separate talk

Be scientific and rigorous

Find the real root causes of your performance problems

At least there's only one thing to optimize

- Our app will have performance in the same ballpark as our mobile website
- We have a mobile website and care about its performance
- All of our speed efforts are going towards the same thing

Learnings

1. Be prepared to deal with webview quirks
2. Demystify loading slowness
3. **Code sharing goes deeper than views**
4. JavaScript lets everyone contribute

Shared infrastructure

- At Quora, the same boxes handle all platforms
 - No API tier

Shared deployment tools

We share the same continuous deployment system we use on web

ZERG Quora Deployment Status

Revision Overview

Finished Failed Canceled Active Revision

Author / Rev	Enqueue time	Unit tests	Packages	Integration	Deploy
Jelle Zijlstra c718b514 bd84b021 3c5861ea 17783d67	Jun 13 2016, 09:03:24 PM	25% Complete, 0 Failures, 2:31 <div>Cancel</div>	us-east-1 ok (1:52) us-west-1 ok (1:39)	0:02	Unreleased
Karthik Naidu 97514d8b	Jun 13 2016, 09:01:20 PM (deployed after 8:54)	7:10 <div>□ Timing</div>	us-east-1 ok (1:49) us-west-1 ok (2:20)	<u>2:21</u>	Jun 13 2016, 09:10:14 PM (9% rollout)

Shared UI integration tests

- If there are 100 buttons and 3 platforms, do you need 300 tests?
- Or just 102

Learnings

1. Be prepared to deal with webview quirks
2. Demystify loading slowness
3. Code sharing goes deeper than views
4. **JavaScript lets everyone contribute**

Javascript lets everyone contribute

Does ISS have a blood bank for astronauts in case of any emergency?



Clayton C. Anderson, US Astronaut,
Retired

366.1k Views • Most Viewed Writer in Astronauts
with 120+ answers

Great question, and the answer is no! If an emergency is serious enough to require blood, astronauts on board the International Space...

Upvote | 15.7k

Downvote Read More



Javascript lets everyone contribute

- Easy ramp-up
- Designers code
- Few projects get blocked on native development

Learnings

1. Be prepared to deal with webview quirks
2. Demystify loading slowness
3. Code sharing goes deeper than views
4. JavaScript lets everyone contribute

Conclusion

- There are pros and cons to any architecture
- This one has worked very well for us over the last 3 years
- If you haven't tried hybrid app development, maybe it's worth considering or exploring
 - either by building your own framework, or using a publically available one

Questions?