Building Multi-Density and Multi-Platform UIs with Flex

Narciso (nj) Jaramillo

Calibrating…

- Have a touchscreen smartphone (Android, iOS, other)?
- Have a touchscreen tablet (Android, iOS, other)?
- Know what a ViewNavigator is?
- Used Flash Builder “Burrito”/Flex “Hero” prerelease?
- Built a mobile Flex app?

Overview

- Challenges in multiscreen development
- Designing adaptive UI for multiple mobile screens
- Building adaptive UI using Flex

What I won’t be covering in depth

- New mobile app components (ViewNavigator, ActionBar, ViewMenu)
- Overall app architecture
- Code sharing between mobile and desktop apps
- Packaging workflows for multiple platforms

Challenges in multiscreen development

What does multiscreen mean?

Form factors

Pixel densities

UI and hardware conventions

Leveraging Flex 4.5 for multiscreen mobile UI development

Classic Flex features	Core Spark components Dynamic layout States and state groups
Mobile components and skins	App components (ViewNavigator / ActionBar / ViewMenu) Cross-platform component skins Alternative skins for certain platform conventions Per-platform CSS rules
DPI management	Automatic DPI-based application scaling DPI-aware skins Multi-DPI bitmaps Per-DPI CSS rules

Designing adaptive UI for multiple mobile screens

Before you design…

Know your platforms

Platform UI guidelines | Great apps | UI patterns

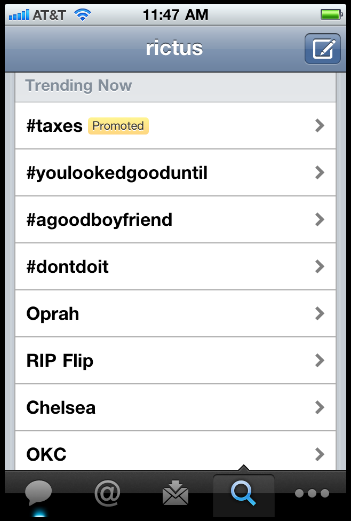
Know your devices

Screen resolutions | Pixel densities | Hardware affordances

Know your app

Core information | Key user tasks | Appropriateness for mobile

UI patterns: Phones


AT&T 11:47 AM
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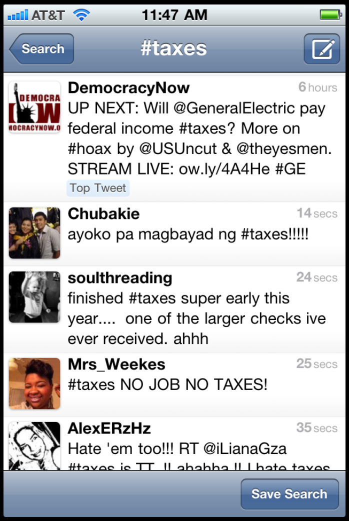
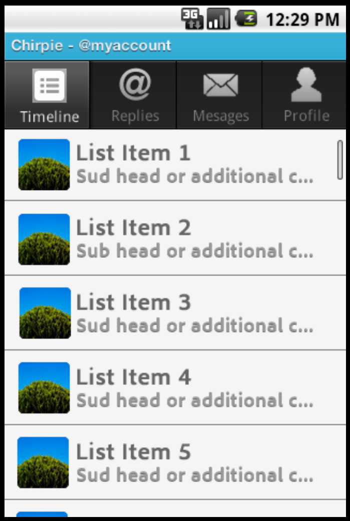
Trending Now
#taxes Promoted
#youlookedgooduntil
#agoodboyfriend
#dontdoit
Oprah
RIP Flip
Chelsea
OKC


AT&T 11:47 AM
Search #taxes
DemocracyNow 6 hours
UP NEXT: Will @GeneralElectric pay federal income #taxes? More on #hoax by @USUncut & @theyesmen. STREAM LIVE: ow.ly/4A4He #GE
Top Tweet
Chubakie 14 secs
ayoko pa magbayad ng #taxes!!!!!
soulthreading 24 secs
finished #taxes super early this year.... one of the larger checks ive ever received. ahhh
Mrs_Weekes 25 secs
#taxes NO JOB NO TAXES!
AlexERzHz 35 secs
Hate 'em too!!! RT @iLianaGza
Save Search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Chirpie - @myaccount
Timeline | Replies | Mesages | Profile
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List Item 5
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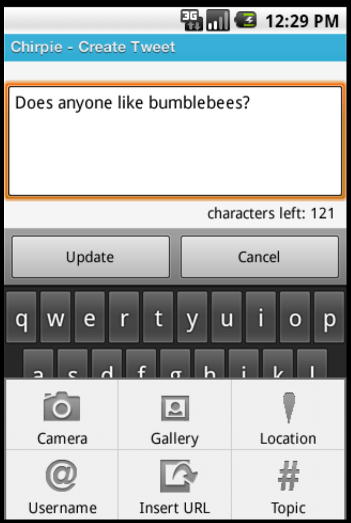
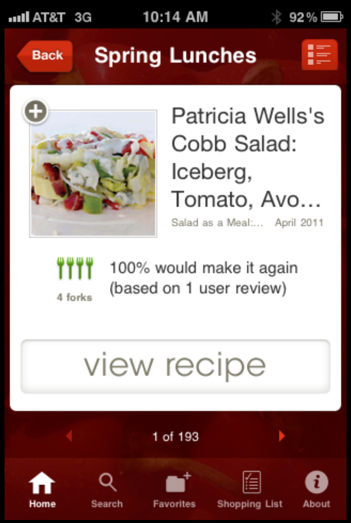
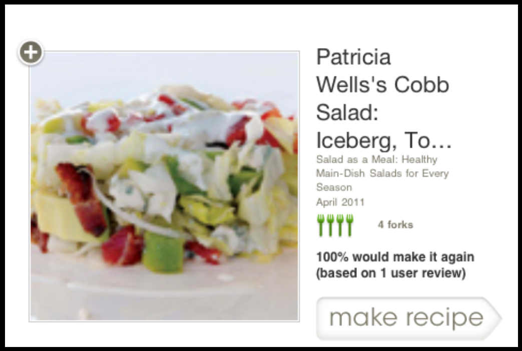
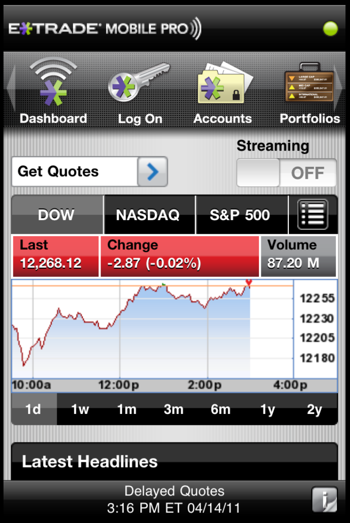

12:29 PM
Chirpie - Create Tweet
Does anyone like bumblebees?
characters left: 121
Update | Cancel
q w e r t y u i o p
Camera | Gallery | Location
Username | Insert URL | Topic


AT&T 3G 10:14 AM 92 %
Back Spring Lunches
Patricia Wells's Cobb Salad: Iceberg, Tomato, Avo...
Salad as a Meal:... April 2011
4 forks
100% would make it again (based on 1 user review)
view recipe
1 of 193
Home | Search | Favorites | Shopping List | About


Patricia Wells's Cobb Salad: Iceberg, To...
Salad as a Meal: Healthy Main-Dish Salads for Every Season
April 2011
4 forks
100% would make it again (based on 1 user review)
make recipe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Dashboard | Log On | Accounts | Portfolios
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Streaming OFF
DOW | NASDAQ | S&P 500

Last	Change	Volume
12,268.12	-2.87 (-0.02%)	87.20 M

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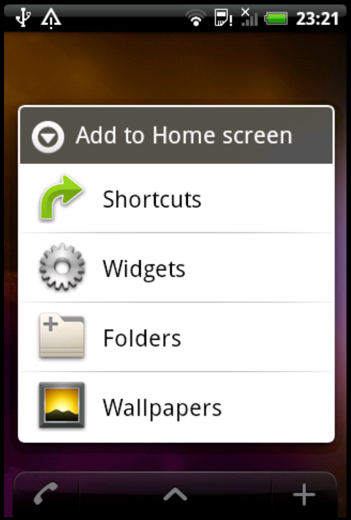
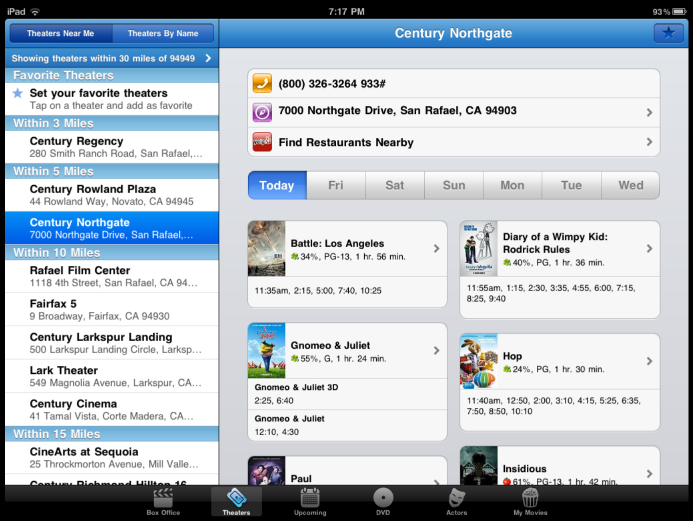

23:21
Add to Home screen
Shortcuts
Widgets
Folders
Wallpapers

UI patterns: Tablets



iPad 7:17 PM 93%

Theaters Near Me | Theaters By Name

Showing theaters within 30 miles of 94949

Favorite Theaters

Set your favorite theaters
Tap on a theater and add as favorite

Within 3 Miles

Century Regency
280 Smith Ranch Road, San Rafael,…

Within 5 Miles

Century Rowland Plaza
44 Rowland Way, Novato, CA 94945

Century Northgate
7000 Northgate Drive, San Rafael,…

Within 10 Miles

Rafael Film Center
1118 4th Street, San Rafael, CA 94…

Fairfax 5
9 Broadway, Fairfax, CA 94930

Century Larkspur Landing
500 Larkspur Landing Circle, Larksp…

Lark Theater
549 Magnolia Avenue, Larkspur, CA…

Century Cinema
41 Tamal Vista, Corte Madera, CA…

Within 15 Miles

CineArts at Sequoia
25 Throckmorton Avenue, Mill Valle…

Century Richmond Hilltop 16

Century Northgate

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7000 Northgate Drive, San Rafael, CA 94903
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Battle: Los Angeles
34%, PG-13, 1 hr. 56 min.
11:35am, 2:15, 5:00, 7:40, 10:25

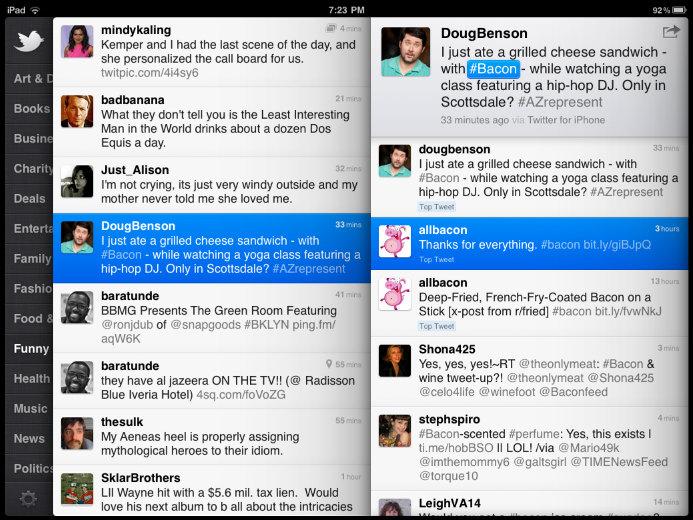
Diary of a Wimpy Kid: Rodrick Rules
40%, PG, 1 hr. 36 min.
11:55am, 1:15, 2:30, 3:35, 4:55, 6:00, 7:15, 8:25, 9:40

Gnomeo & Juliet
55%, G, 1 hr. 24 min.
Gnomeo & Juliet 3D
2:25, 6:40
Gnomeo & Juliet
12:10, 4:30

Hop
24%, PG, 1 hr. 30 min.
11:40am, 12:50, 2:00, 3:10, 4:15, 5:25, 6:35, 7:50, 8:50, 10:10

Paul

Insidious
61%, PG-13, 1 hr. 42 min.



iPad 7:23 PM 92%

mindykaling 4 mins
Kemper and I had the last scene of the day, and she personalized the call board for us. twitpic.com/4i4sy6

badbanana 21 mins
What they don't tell you is the Least Interesting Man in the World drinks about a dozen Dos Equis a day.

Just_Alison 32 mins
I'm not crying, its just very windy outside and my mother never told me she loved me.

DougBenson 33 mins
I just ate a grilled cheese sandwich - with #Bacon - while watching a yoga class featuring a hip-hop DJ. Only in Scottsdale? #AZrepresent

baratunde 41 mins
BBMG Presents The Green Room Featuring @ronjdub of @snapgoods #BKLYN ping.fm/aqW6K

baratunde 55 mins
they have al jazeera ON THE TV!! (@ Radisson Blue Iveria Hotel) 4sq.com/foVoZG

thesulk 55 mins
My Aeneas heel is properly assigning mythological heroes to their idiom.

SklarBrothers 1 hour
LIl Wayne hit with a $5.6 mil. tax lien. Would love his next album to b all about the intricacies

DougBenson
I just ate a grilled cheese sandwich - with #Bacon - while watching a yoga class featuring a hip-hop DJ. Only in Scottsdale? #AZrepresent
33 minutes ago via Twitter for iPhone

dougbenson 33 mins
I just ate a grilled cheese sandwich - with #Bacon - while watching a yoga class featuring a hip-hop DJ. Only in Scottsdale? #AZrepresent
Top Tweet

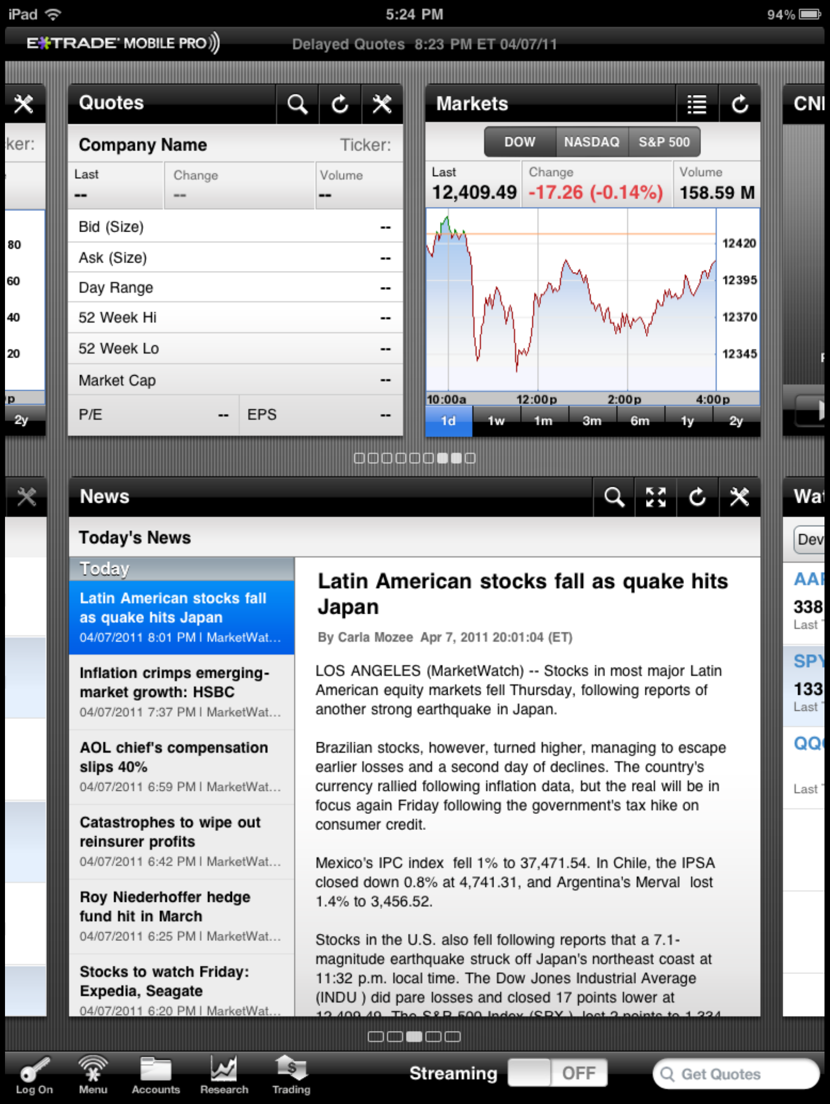
allbacon 3 hours
Thanks for everything. #bacon bit.ly/giBJpQ
Top Tweet

allbacon 13 hours
Deep-Fried, French-Fry-Coated Bacon on a Stick [x-post from r/fried] #bacon bit.ly/fvwNkJ
Top Tweet

Shona425 3 mins
Yes, yes, yes!~RT @theonlymeat: #Bacon & wine tweet-up?! @theonlymeat @Shona425 @celo4life @winefoot @Baconfeed

stephspiro 4 mins
#Bacon-scented #perfume: Yes, this exists l ti.me/hobBSO ll LOL! /via @Mario49k @imthemommy6 @galtsgirl @TIMENewsFeed @torque10

LeighVA14 14 mins



iPad 5:24 PM 94%

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Quotes

Company Name		Ticker:	
Last	Change	Volume	
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Bid (Size)			--
Ask (Size)			--
Day Range			--
52 Week Hi			--
52 Week Lo			--
Market Cap			--
P/E	--	EPS	--

Markets

DOW | NASDAQ | S&P 500

Last	Change	Volume
12,409.49	-17.26 (-0.14%)	158.59 M

News

Today's News

Today

Latin American stocks fall as quake hits Japan
04/07/2011 8:01 PM I MarketWat…

Inflation crimps emerging-market growth: HSBC
04/07/2011 7:37 PM I MarketWat…

AOL chief's compensation slips 40%
04/07/2011 6:59 PM I MarketWat…

Catastrophes to wipe out reinsurer profits
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Roy Niederhoffer hedge fund hit in March
04/07/2011 6:25 PM I MarketWat…

Stocks to watch Friday: Expedia, Seagate
04/07/2011 6:20 PM I MarketWat…

Latin American stocks fall as quake hits Japan

By Carla Mozee Apr 7, 2011 20:01:04 (ET)

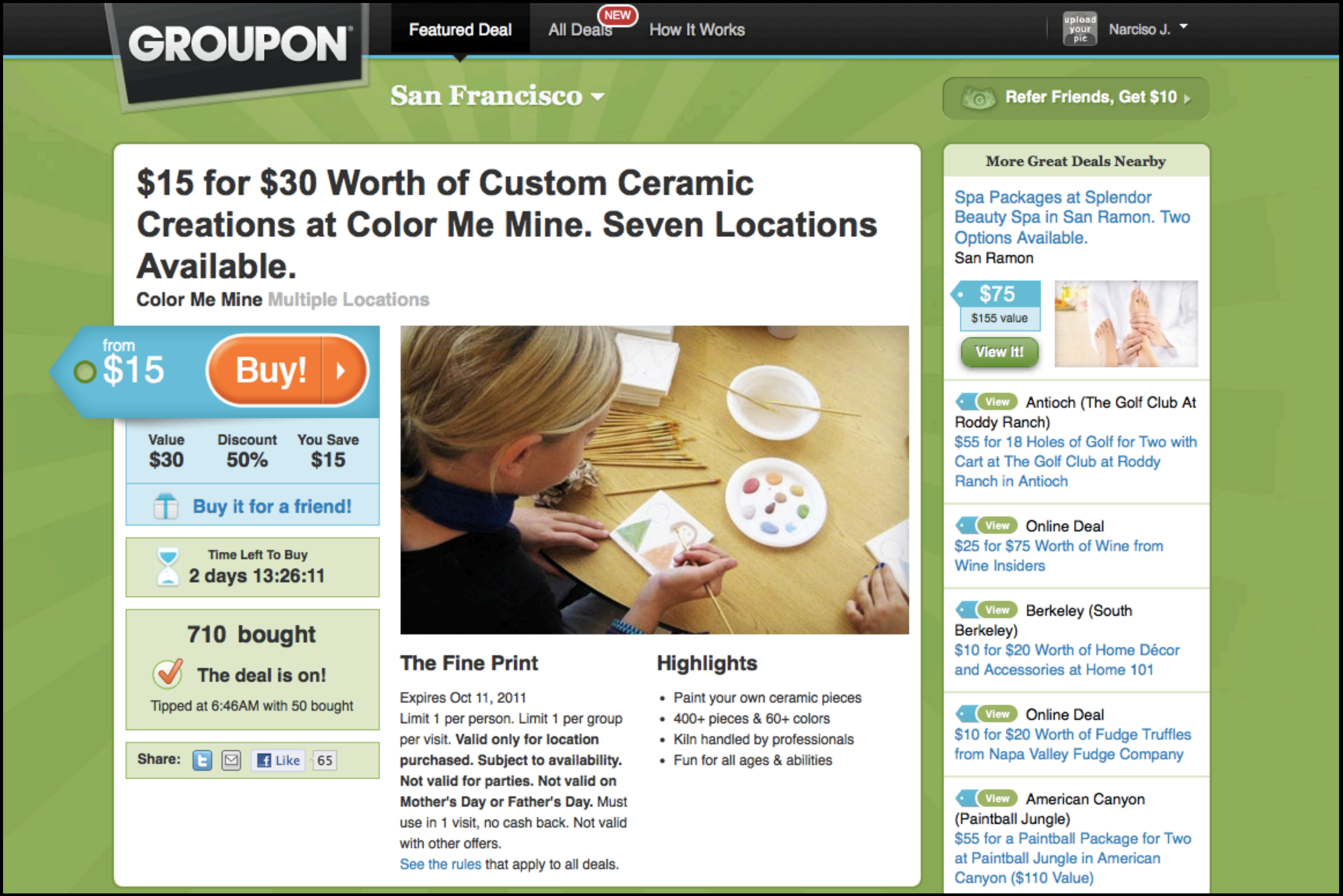
LOS ANGELES (MarketWatch) -- Stocks in most major Latin American equity markets fell Thursday, following reports of another strong earthquake in Japan.

Brazilian stocks, however, turned higher, managing to escape earlier losses and a second day of declines. The country's currency rallied following inflation data, but the real will be in focus again Friday following the government's tax hike on consumer credit.

Mexico's IPC index fell 1% to 37,471.54. In Chile, the IPSA closed down 0.8% at 4,741.31, and Argentina's Merval lost 1.4% to 3,456.52.

Stocks in the U.S. also fell following reports that a 7.1-magnitude earthquake struck off Japan's northeast coast at 11:32 p.m. local time. The Dow Jones Industrial Average (INDU) did pare losses and closed 17 points lower at

Example: Floupon – a Groupon browser



$15 for $30 Worth of Custom Ceramic Creations at Color Me Mine. Seven Locations Available.

Color Me Mine Multiple Locations

from $15 Buy!

Value	Discount	You Save
$30	50%	$15

Buy it for a friend!

Time Left To Buy
2 days 13:26:11

710 bought
The deal is on!
Tipped at 6:46AM with 50 bought

Share: Like 65

The Fine Print

Expires Oct 11, 2011
Limit 1 per person. Limit 1 per group per visit. **Valid only for location purchased. Subject to availability. Not valid for parties. Not valid on Mother's Day or Father's Day.** Must use in 1 visit, no cash back. Not valid with other offers.
See the rules that apply to all deals.

Highlights

- Paint your own ceramic pieces
- 400+ pieces & 60+ colors
- Kiln handled by professionals
- Fun for all ages & abilities

More Great Deals Nearby

Spa Packages at Splendor Beauty Spa in San Ramon. Two Options Available.
San Ramon
$75
$155 value
View It!

View Antioch (The Golf Club At Roddy Ranch)
$55 for 18 Holes of Golf for Two with Cart at The Golf Club at Roddy Ranch in Antioch

View Online Deal
$25 for $75 Worth of Wine from Wine Insiders

View Berkeley (South Berkeley)
$10 for $20 Worth of Home Décor and Accessories at Home 101

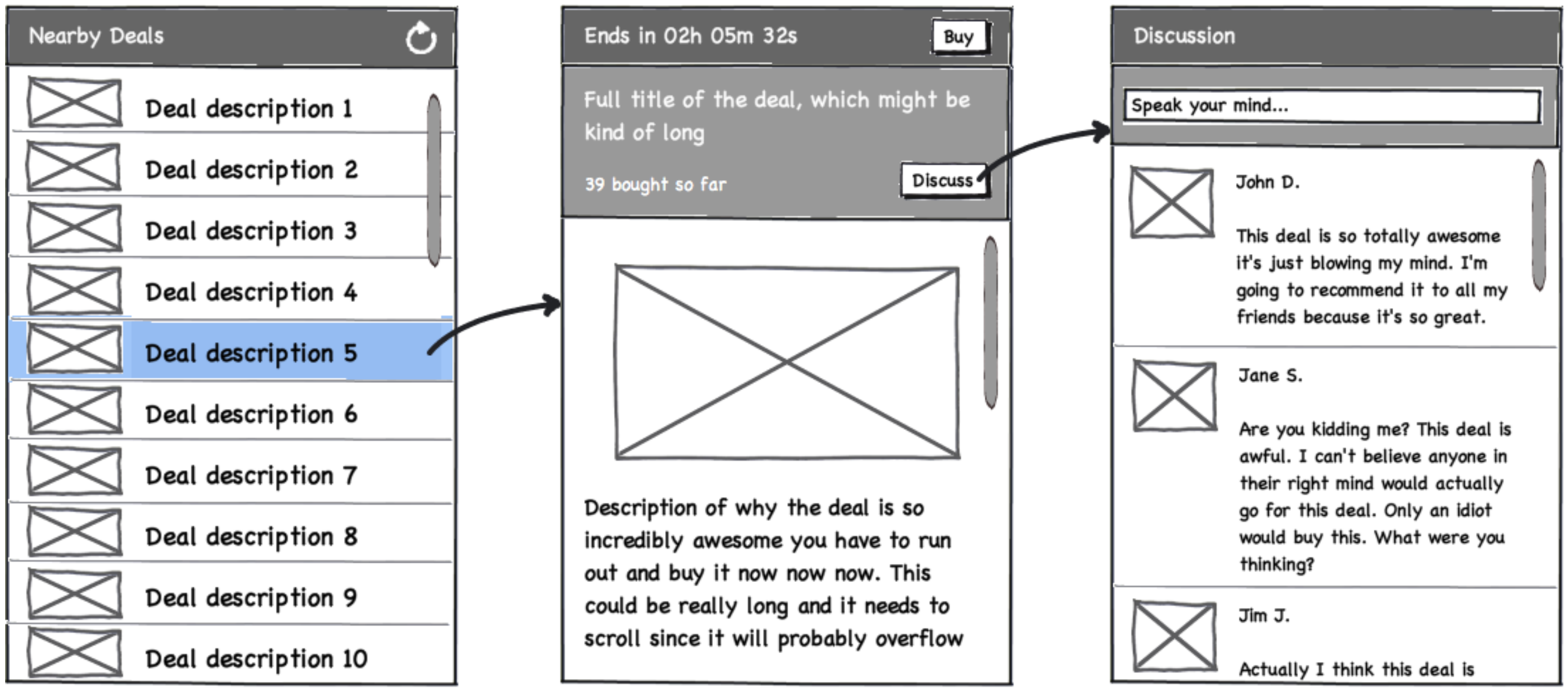
View Online Deal
$10 for $20 Worth of Fudge Truffles from Napa Valley Fudge Company

View American Canyon (Paintball Jungle)
$55 for a Paintball Package for Two at Paintball Jungle in American Canyon ($110 Value)

Example: Floupon – a Groupon browser

- Information
  - Deals for current location
  - Info on a specific deal
  - Discussions for a given deal
- User tasks
  - Refresh the deal list
  - Buy a deal
  - Post to a deal discussion

Floupon: Phone version

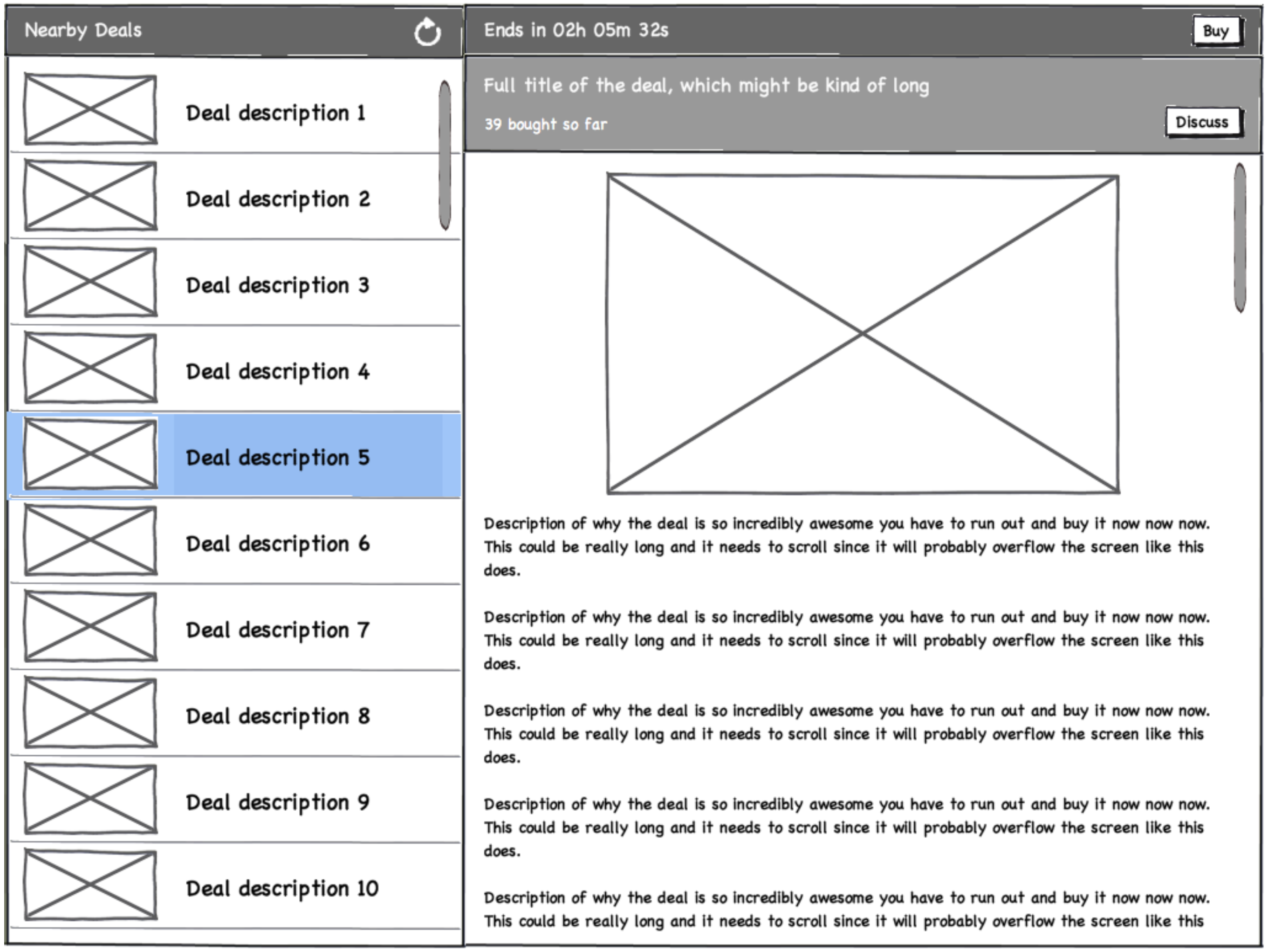

Nearby Deals
Deal description 1
Deal description 2
Deal description 3
Deal description 4
Deal description 5
Deal description 6
Deal description 7
Deal description 8
Deal description 9
Deal description 10
Ends in 02h 05m 32s
Buy
Full title of the deal, which might be kind of long
39 bought so far
Discuss
Description of why the deal is so incredibly awesome you have to run out and buy it now now now. This could be really long and it needs to scroll since it will probably overflow
Discussion
Speak your mind...
John D.
This deal is so totally awesome it's just blowing my mind. I'm going to recommend it to all my friends because it's so great.
Jane S.
Are you kidding me? This deal is awful. I can't believe anyone in their right mind would actually go for this deal. Only an idiot would buy this. What were you thinking?
Jim J.
Actually I think this deal is

Deal summary view

Detail view

Discussion view

Floupon: Tablet version (landscape)



Description of why the deal is so incredibly awesome you have to run out and buy it now now now. This could be really long and it needs to scroll since it will probably overflow the screen like this does.

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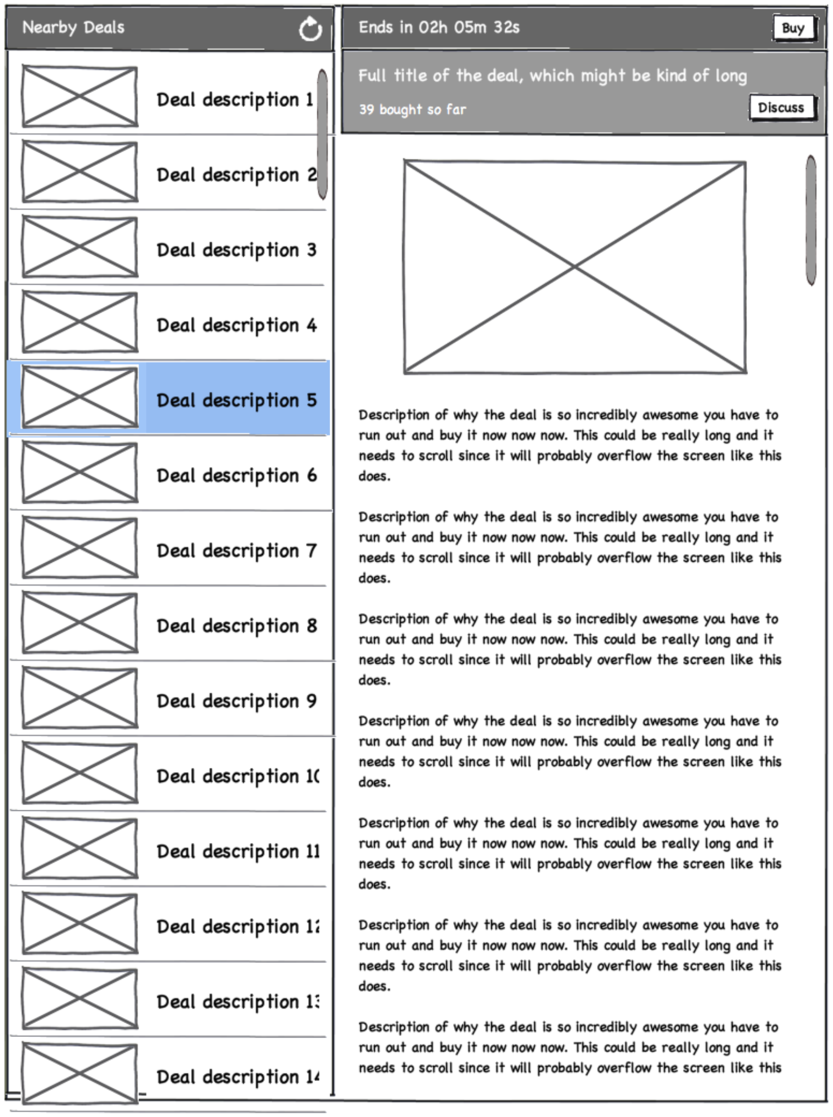
Floupon: Tablet version (portrait)



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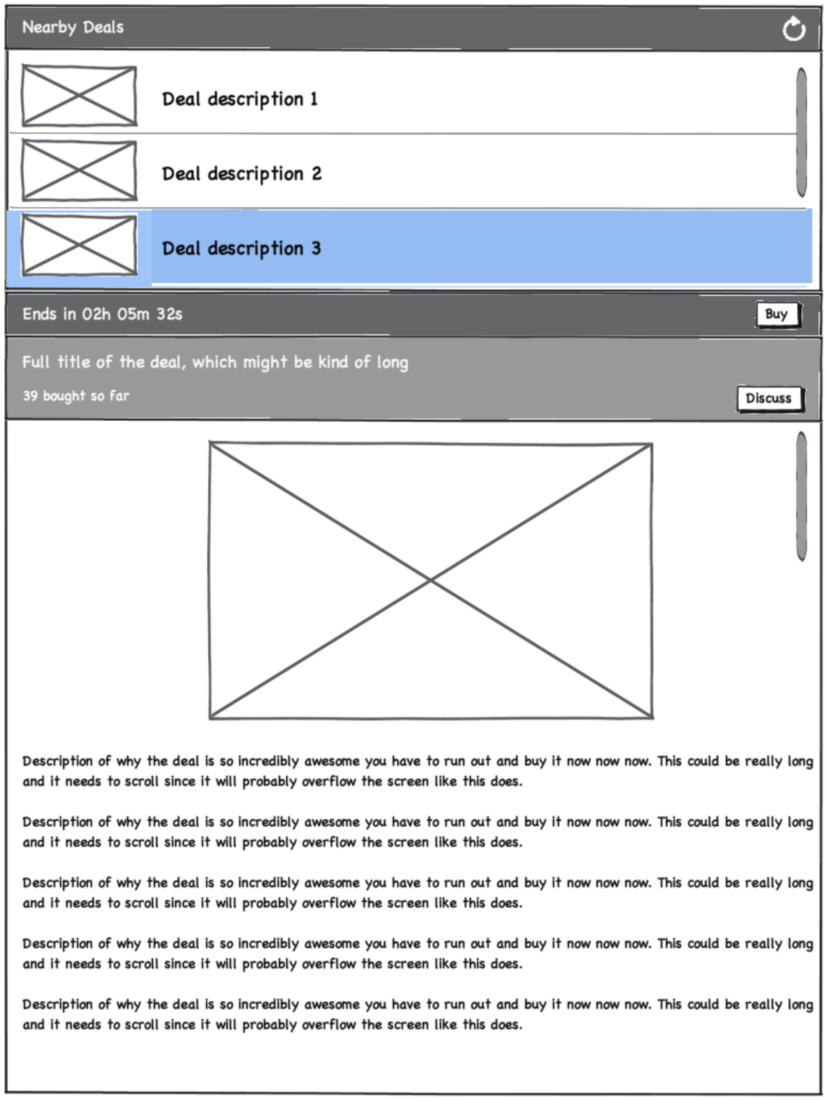
Floupon: Tablet version (portrait)


Nearby Deals

Deal description 1

Deal description 2

Deal description 3

Ends in 02h 05m 32s

Buy

Full title of the deal, which might be kind of long

39 bought so far

Discuss

Description of why the deal is so incredibly awesome you have to run out and buy it now now now. This could be really long and it needs to scroll since it will probably overflow the screen like this does.

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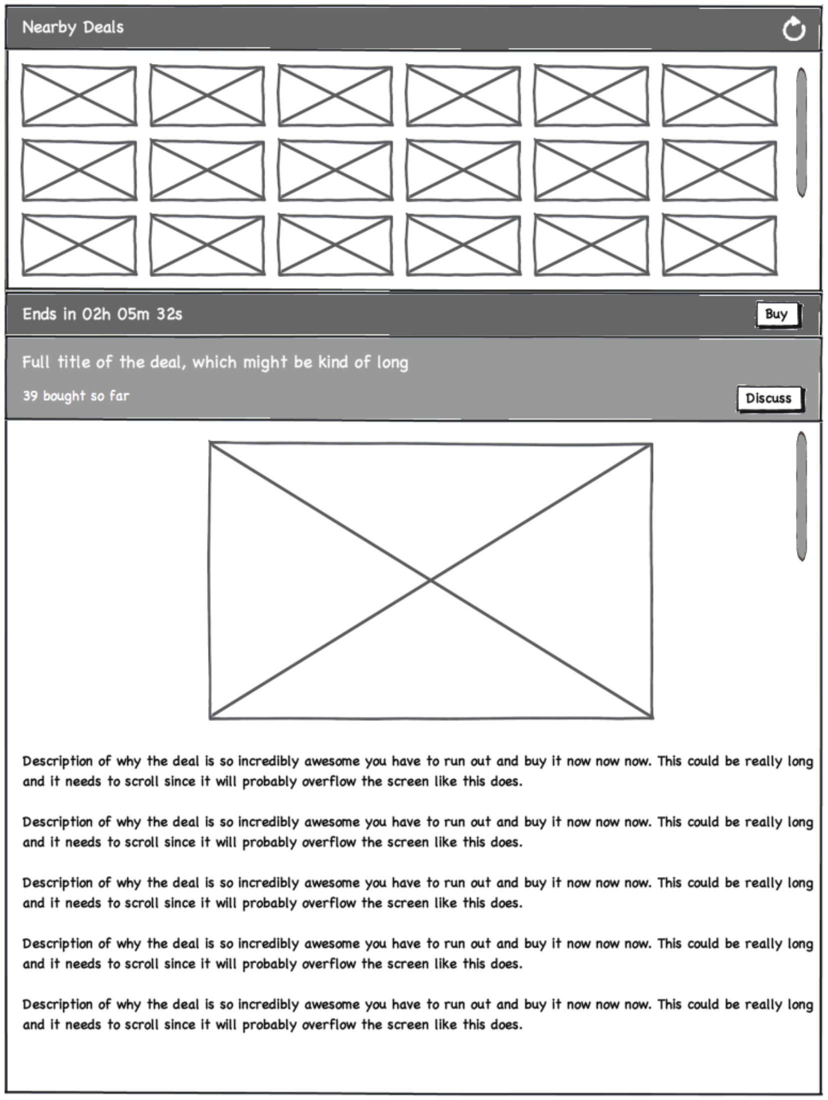
Floupon: Tablet version (portrait)



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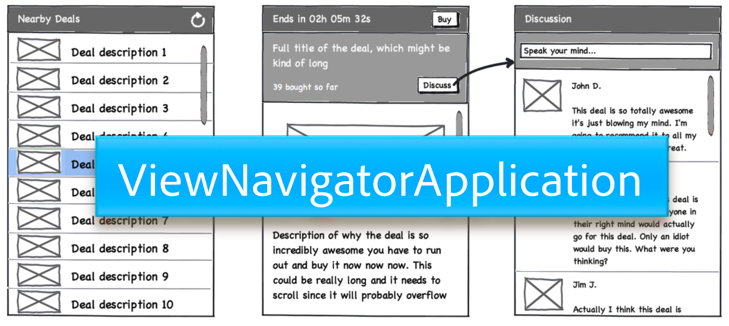
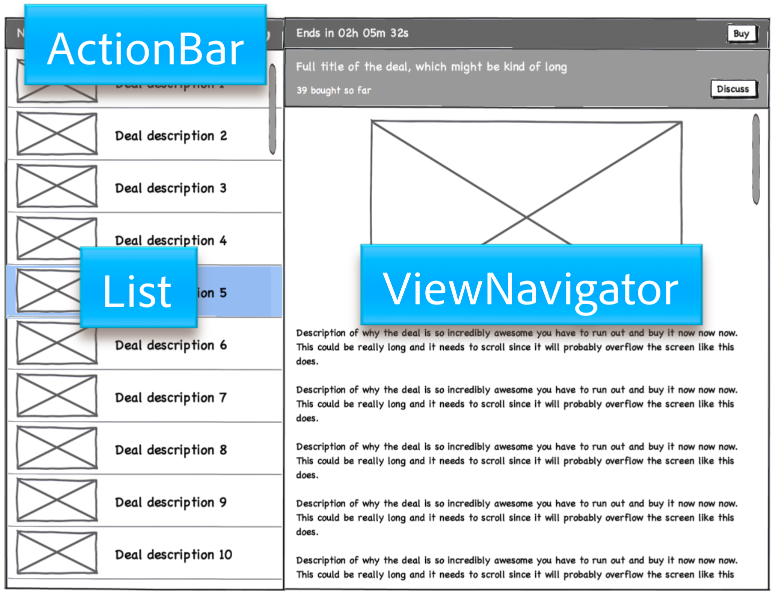
Building adaptive UI with Flex: Phone vs. tablet

Floupon: Separate phone and tablet apps



Deal summary view   Detail view   Discussion view



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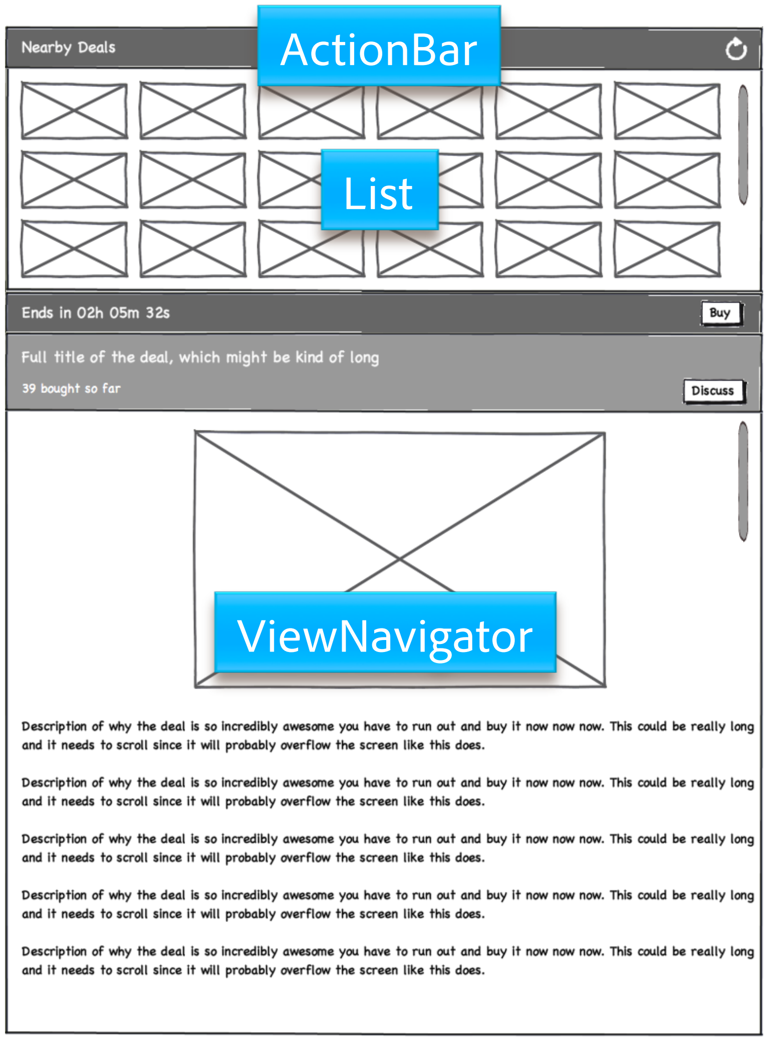
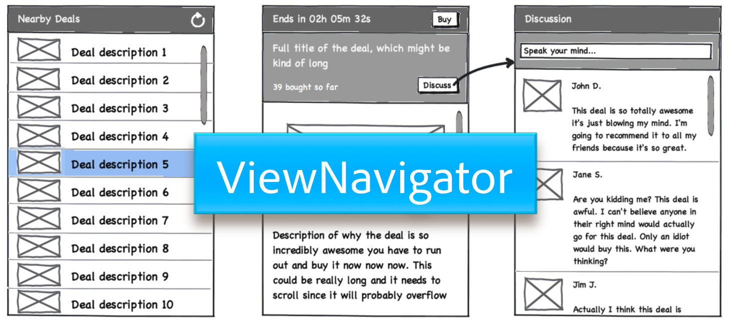


Description of why the deal is so incredibly awesome you have to run out and buy it now now now. This could be really long and it needs to scroll since it will probably overflow the screen like this does.

Floupon: Unified phone and tablet app



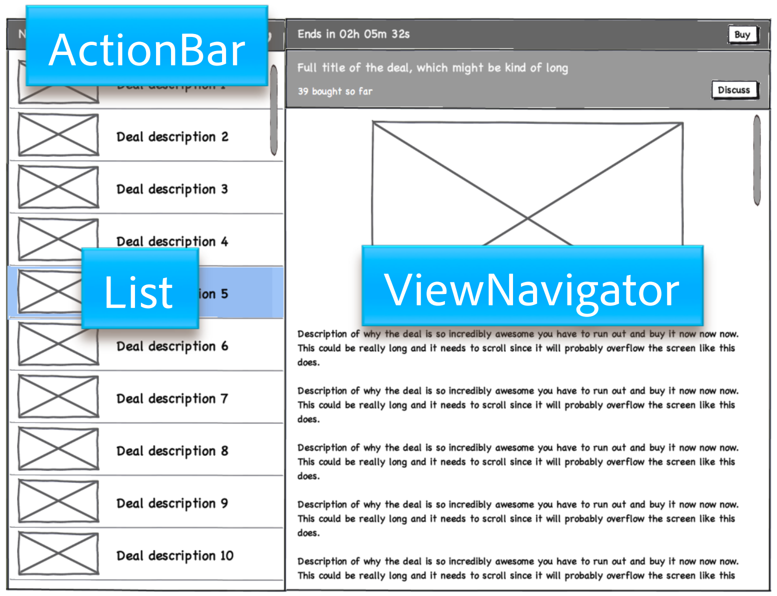
Description of why the deal is so incredibly awesome you have to run out and buy it now now now. This could be really long and it needs to scroll since it will probably overflow

This deal is so totally awesome it's just blowing my mind. I'm going to recommend it to all my friends because it's so great.

Are you kidding me? This deal is awful. I can't believe anyone in their right mind would actually go for this deal. Only an idiot would buy this. What were you thinking?

Actually I think this deal is

Deal summary view   Detail view   Discussion view



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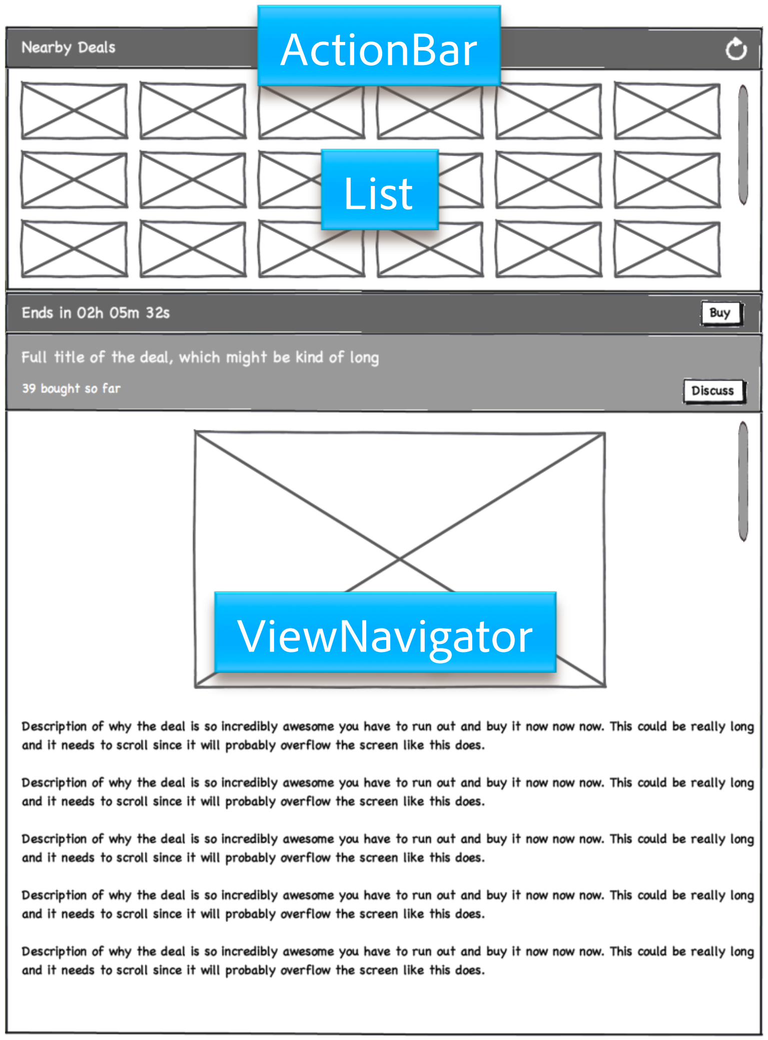


Description of why the deal is so incredibly awesome you have to run out and buy it now now now. This could be really long and it needs to scroll since it will probably overflow the screen like this does.

Handling the Back key

```
private function initializeHandler(event:Event):void
{
        systemManager.stage.addEventListener(KeyboardEvent.KEY_DOWN,
                deviceKeyDownHandler);
        systemManager.stage.addEventListener(KeyboardEvent.KEY_UP,
                deviceKeyUpHandler);
}

private function deviceKeyDownHandler(event:KeyboardEvent):void
{
        if (event.keyCode == Keyboard.BACK && mainNavigator.length > 1)
                event.preventDefault();
}

private function deviceKeyUpHandler(event:KeyboardEvent):void
{
        if (event.keyCode == Keyboard.BACK && mainNavigator.length > 1)
                mainNavigator.popView();
}
```

Using states to handle layout variations

```
private function resizeHandler(event:ResizeEvent):void
{
        var isPortrait:Boolean = height > width;
        var isTablet:Boolean = height > 960 || width > 960;

        currentState = (isPortrait ? "portrait" : "landscape") +
                       (isTablet ? "Tablet" : "Phone");
}


<ViewNavigator id="mainNavigator"
        left="0" left.landscapeTablet="{LIST_WIDTH}"
        top="0" top.portraitTablet="{ACTIONBAR_HEIGHT + LIST_HEIGHT}"
        right="0" bottom="0"
        firstView="views.SummaryView"
        firstView.landscapeTablet="views.DetailView”
        firstView.portraitTablet=“views.DetailView”
/>
```

Using state groups

```
<states>
        <State name="portraitPhone"   stateGroups="portrait,phone"/>
        <State name="landscapePhone"  stateGroups="landscape,phone"/>
        <State name="portraitTablet"  stateGroups="portrait,tablet"/>
        <State name="landscapeTablet" stateGroups="landscape,tablet"/>
</states>
```

```
<ViewNavigator id="mainNavigator"
        left="0" left.landscapeTablet="{LIST_WIDTH}"
        top="0" top.portraitTablet="{ACTIONBAR_HEIGHT + LIST_HEIGHT}"
        right="0" bottom="0"
        firstView="views.SummaryView"
        firstView.tablet="views.DetailView”
/>
```

Managing states in views

```
private function handleViewActivate(): void
{
      setCurrentState(getCurrentViewState());
}

override public function getCurrentViewState(): String
{
      var newState: String = getPlatform() +
                  (isTablet() ? "Tablet" : "Phone");
      if (hasState(newState))
            return newState;
      else
            return currentState;
}
```

DEMO: Floupon running on Droid Pro, iPad (portrait/landscape).

Building adaptive UI with Flex: Density management

DEMO: App designed for 160 dpi running on Droid 2, iPhone 4 with no autoscaling.

CHEAT SHEET: How to deal with density

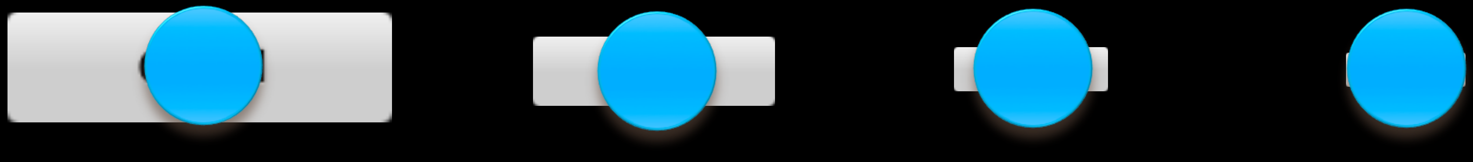
Set applicationDPI="160" on your application tag

Lay out your application for a 160 dpi device

Use MultiDPIBitmapSource for all bitmaps

Multiple densities: The problem

150 x 40 pixel button



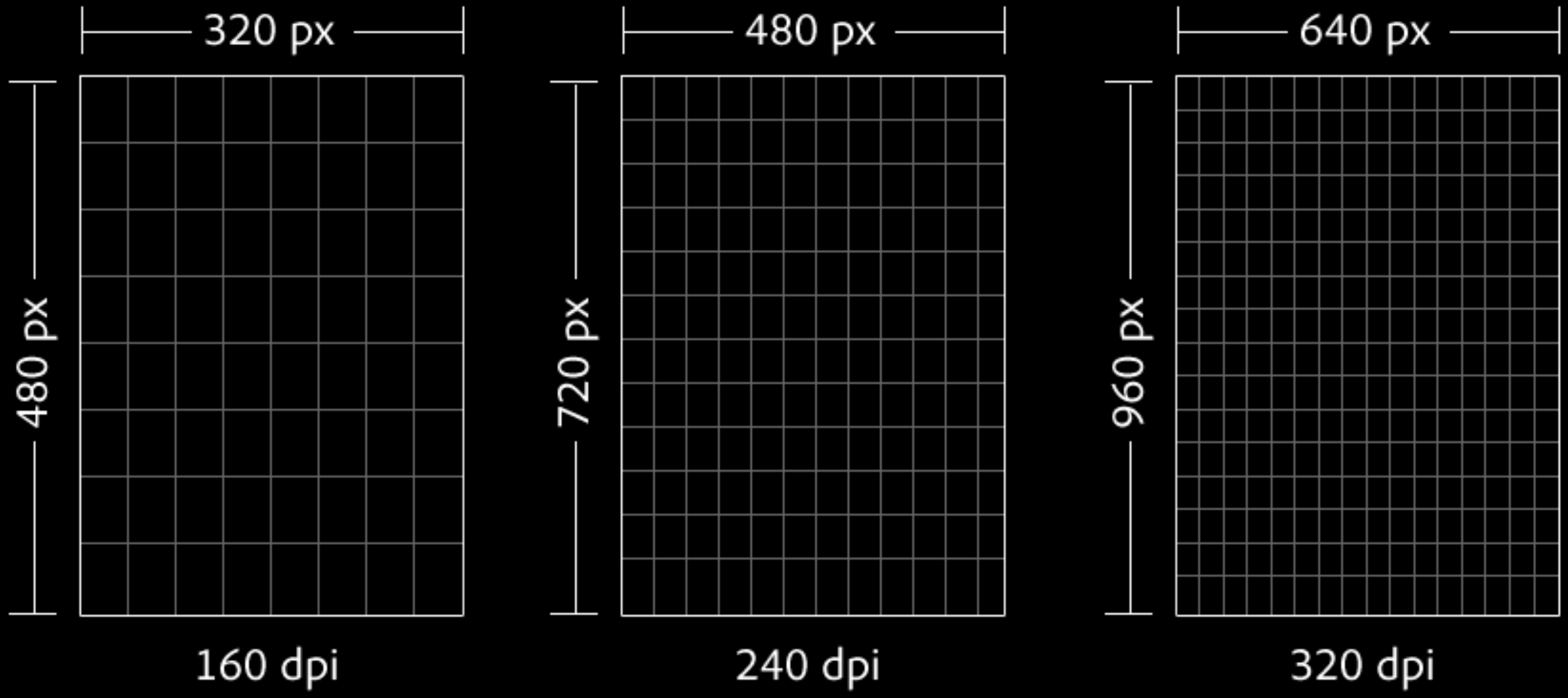
Desktop monitor	Galaxy Tab	Droid 2	iPhone 4
@100 dpi	@160 dpi	@240 dpi	@320 dpi
= 1.5" x 0.4"	= 0.9" x 0.25"	= 0.6" x 0.17"	= 0.46" x 0.13"

Same pixel count, different physical sizes

(Minimum recommended size: 0.25" x 0.25")

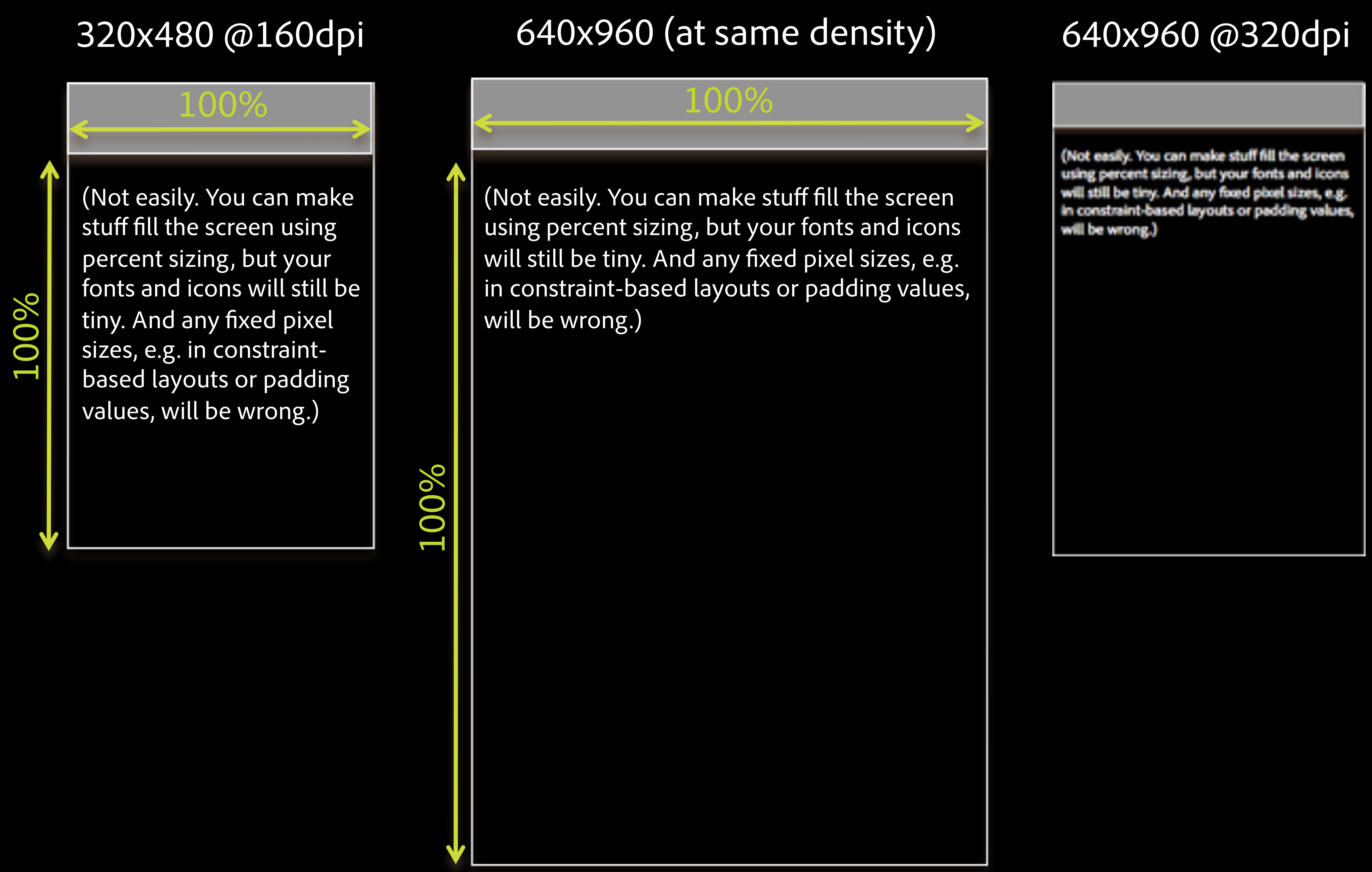
Another perspective

3.5" diagonal screen



Same physical size, different pixel counts

Can I use dynamic layout to solve this?



(Not easily. You can make stuff fill the screen using percent sizing, but your fonts and icons will still be tiny. And any fixed pixel sizes, e.g. in constraint-based layouts or padding values, will be wrong.)

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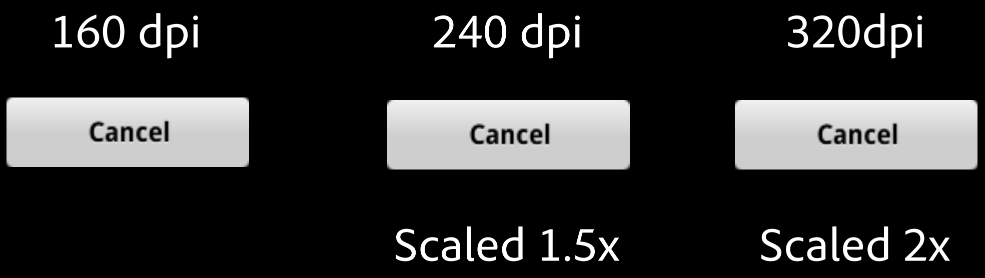
Solution: Automatic scaling for different DPIs

```
<Application applicationDPI="160">
        <Button width="160" height="40"/>
</Application>
```



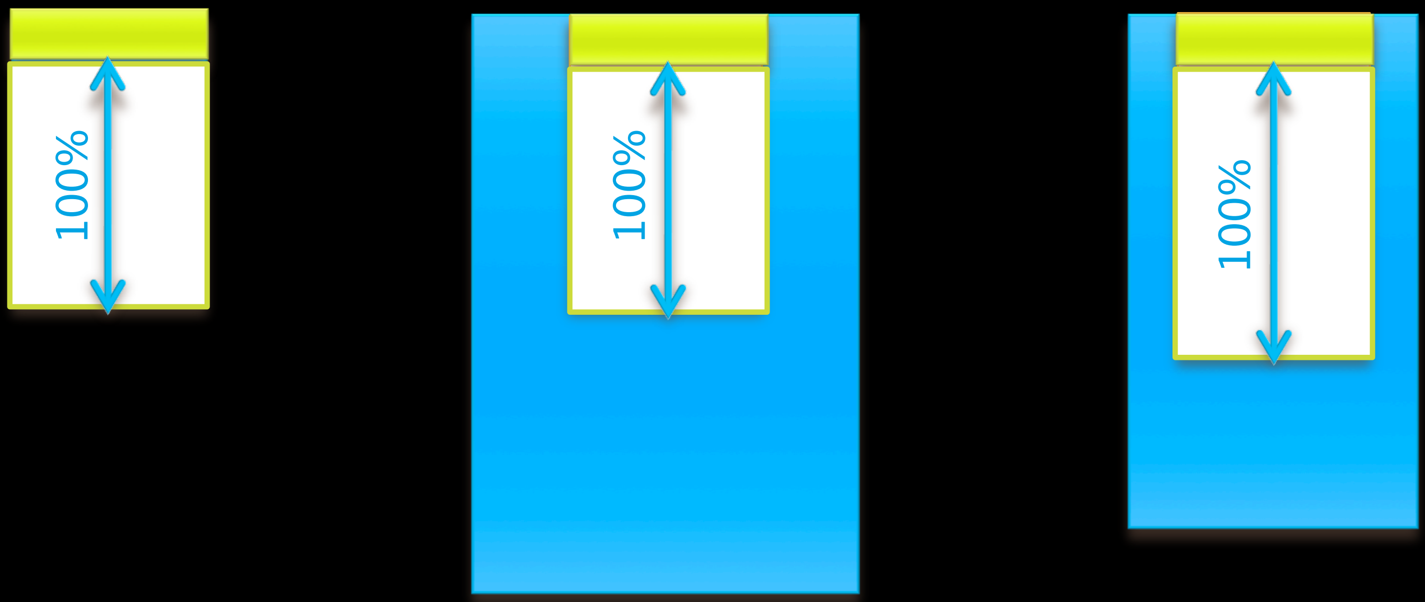
REMEMBER: To your code, the screen is always 160 dpi, and this button is always **160 x 40**, regardless of how the application is being scaled.

Resolution and density

Droid Pro
320 x 480 @160dpi

iPhone 4
640 x 960 @320dpi
= 320 x 480 @160dpi

Droid 2
480 x 854 @240dpi
= 320 x 570 @160dpi



Use **scaling** (applicationDPI) to deal with **density differences**
Use **resizing** (dynamic layout) to deal with **physical size/aspect ratio differences**

DEMO: App running on device with proper autoscaling (Droid 2, iPhone 4).

Scaling different types of objects

Lorem

Ipsum

Dolor

Vectors
scale up well
(scaling down can be bad)
Outlines may blur slightly

Text
scales up well
(Flash scales font size)

Bitmaps
do not scale up well

DEMO: Refresh button icon without MultiDPIBitmapSource (on desktop).

Flex density concepts: Multi-DPI bitmaps

```
<Button click="dealSummaryList.refresh()">
    <icon>
        <MultiDPIBitmapSource
           source160dpi="@Embed('assets/refresh160.png')"
           source240dpi="@Embed('assets/refresh240.png')"
           source320dpi="@Embed('assets/refresh320.png')"/>
    </icon>
</Button>
```

Design icon for 160 dpi

Make a 1.5x bigger version for 240 dpi

Make a 2x bigger version for 320 dpi

(e.g. 32x32, 48x48, 64x64)

DEMO: Refresh button icon with MultiDPIBitmapSource.

Default mapping for DPI classifications

Flex groups devices into **DPI classifications** based on actual device density

Classification	160 DPI	240 DPI	320 DPI
Devices	Most tablets iPhone 3GS Motorola Droid Pro	Most Android phones	iPhone 4
Mapped range	< 200 DPI	>= 200 DPI <= 280 DPI	> 280 DPI
Typical range	132 DPI (iPad) to 181 DPI (HTC Hero)	217 DPI (HTC Evo) to 254 DPI (NexusOne)	326 DPI (iPhone 4)

Can override default mappings using **runtimeDPIProvider**

Source: http://en.wikipedia.org/wiki/List_of_displays_by_pixel_density

CHEAT SHEET revisited

Set applicationDPI="160" on your application tag

Lay out your application for a 160 dpi device

Use MultiDPIBitmapSource for all bitmaps

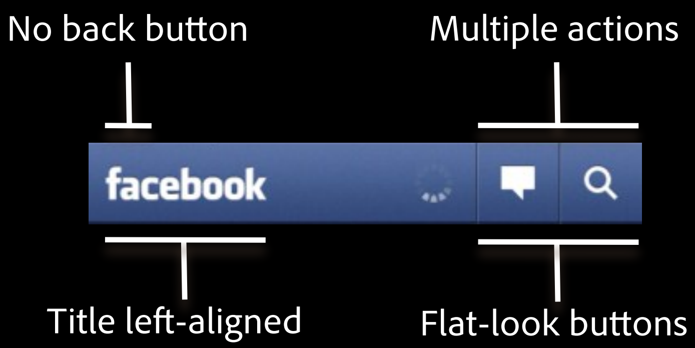
Manual DPI management

- Leave applicationDPI unset (will default to same as runtimeDPI)
- Built-in component skins in mobile theme will adapt to different DPIs
- Your own layouts and skins will need to adapt (pixel and font sizes)
  - Can use @media to set CSS rules for different DPIs
  - Use data binding or code to adapt layout properties per DPI
  - Multi-DPI bitmaps still work

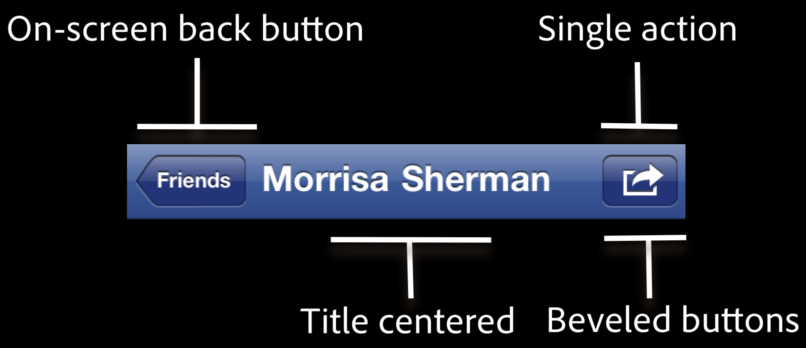
Building adaptive UI with Flex: Multiple platforms

UI differences across platforms

Android phone



iPhone



Per-platform style rules

```
@media (os-platform: "ios") {
      ActionBar {
            defaultButtonAppearance: "beveled”;
            titleAlign: "center”;
      }
}
```

Using states for platform differences

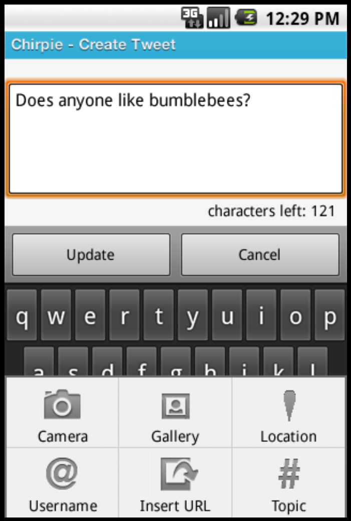
```
<states>
  <State name="androidPhone" stateGroups="phone"/>
  <State name="androidTablet" stateGroups="tablet"/>
  <State name="iosPhone” stateGroups="phone,needsBackButton"/>
  <State name="iosTablet" stateGroups="tablet,needsBackButton"/>
  <State name=“playbook” stateGroups=“tablet,needsBackButton”/>
</states>

<navigationContent>
  <Button includeIn="needsBackButton" label="Back"
          click="handleBackClick()"/>
</navigationContent>
```

DEMO: App running on iPhone/iPad compared to Droid 2/Galaxy Tab.

Other common platform differences

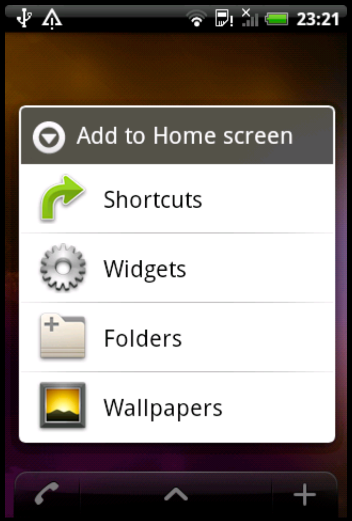
Android

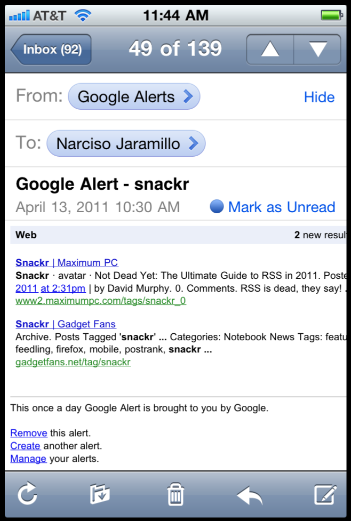
iOS



Does anyone like bumblebees?

characters left: 121





From: Google Alerts

To: Narciso Jaramillo

Google Alert - snackr

April 13, 2011 10:30 AM

Web **2** new resul

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This once a day Google Alert is brought to you by Google.

Remove this alert.
Create another alert.
Manage your alerts.

Menu button (use ViewMenu)

Longpress menu (use List, SkinnablePopup Container)

Bottom toolbar (can use HGroup or SkinnableContainer)

Know your platforms!

Conclusion

Key takeaways

Design for multiple screens

Resolution | Orientation | Density | Platform

Use states to handle layout and platform variations

Use applicationDPI to handle density

Test on desktop or on device

What next?

- Watch my blog: rictus.com/muchado for slides and code
- Follow me on Twitter: @rictus
- Look forward to Android support in the May release…
- … and iOS and PlayBook support in the June release!

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