MAX

Performance-Tuning Mobile Flex Applications

Evtim Georgiev

Computer Scientist, Flex SDK

http://evtimmy.com

Steve Shongrunden

Computer Scientist, Flex SDK

http://flexponential.com

Performance-Tuning Mobile Flex Applications

MAX
CONNECT. DISCOVER. INSPIRE.

- Performance Metrics
- General Tips
- Item Renderers
- Views
- Performance Optimizations in Flex 4.6
- Q & A

Adobe

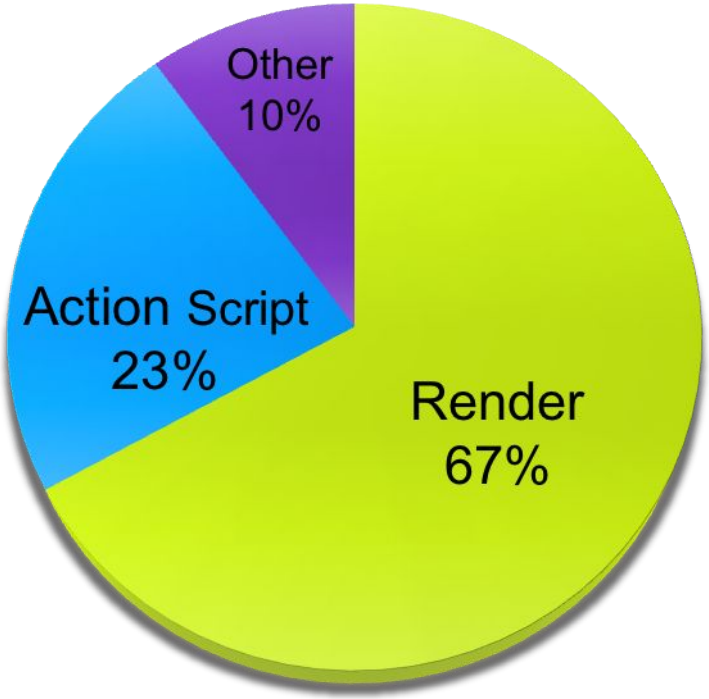
Performance Metrics

Performance Metrics

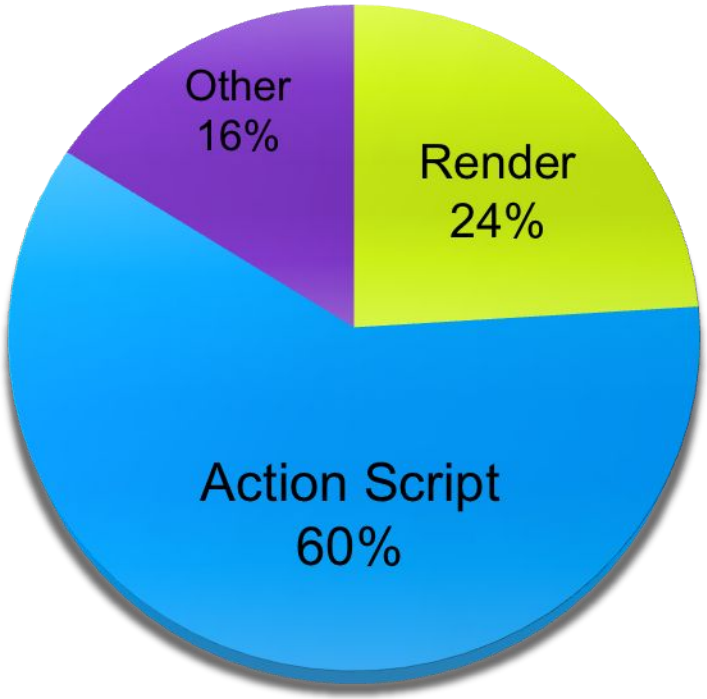
- Metrics
  - Types of Execution Time
    - Frame rate (fps)
    - Startup / validation time
  - Memory
  - SWF Size

Where is Time Spent?

Critical Areas: Object Creation, Measurement/Layout, Render



Effects, Scrolling, Transitions



Startup, Navigation, Data processing

General Tips

Rules of Thumb

- Use the best component for the job
- Cache and queue external content
- Set cacheAsBitmap on graphics that change infrequently but redraw often
- Minimize nested containers

Spark Image and BitmapImage Tips

- BitmapImage vs Image
- Caching and Queuing (New in Flex 4.5)
  - ContentCache class
    - Cache on by default
    - Queue off by default
  - contentLoader property on Spark Image, BitmapImage
  - IContentLoader interface
- Use PNG instead of GIF/JPEG
- Avoid large images for small icons

Text Components

- **Label - light**
  - Single-styled
  - Recommended for static text (mobile & desktop)
  - Used by DefaultItemRenderer (desktop)
- **RichText - heavier**
  - Multi-styled
- **RichEditableText - heaviest**
  - Selection, edit
  - Used by TextInput and TextArea (desktop)

Spark Text Components

- **StyleableTextField (New in Flex 4.5)**
  - Mobile support for edit and selection (turn off if not needed!)
  - Used by LabelItemRenderer & IconItemRenderer (mobile)
  - Can’t use directly in MXML
- **StyleableStageText (New in Flex 4.6)**
  - Native OS text control
    - Responsive editing
    - Really fast scrolling
  - Used by TextInput and TextArea (mobile)
  - Can’t use directly in MXML

ItemRenderers

ItemRenderers in Spark

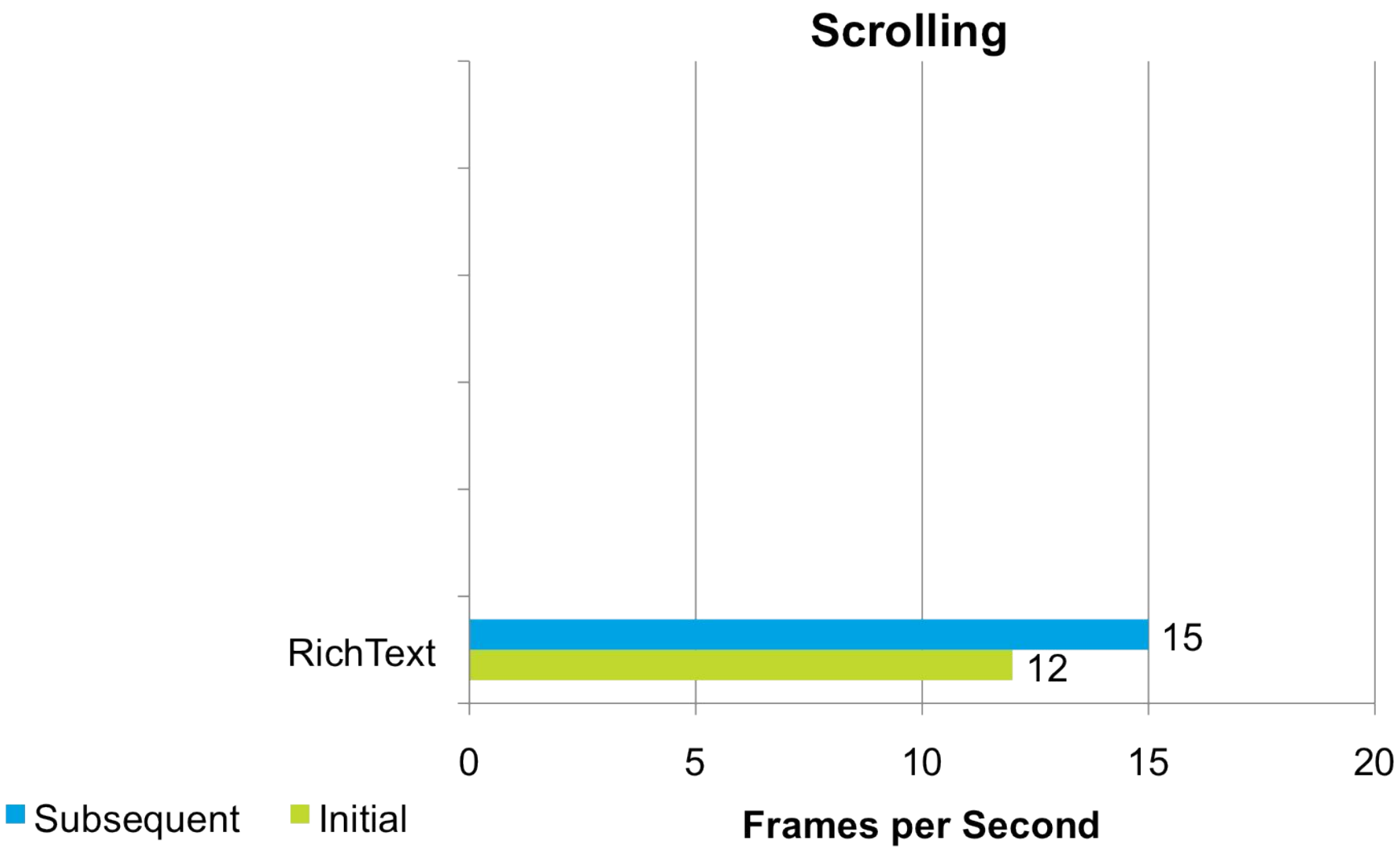
- Creating ItemRenderers in MXML is quick and simple
- Avoid creating heavy ItemRenderers
  - Don’t use heavy (text) components
  - Cache and queue external content requests
  - Use cacheAsBitmap (carefully!)
  - Turn off “autoDrawBackground” if not needed
  - Avoid Filters / drop shadows
  - Avoid complex binding expressions
  - Reduce number of nested Groups
- Use the mobile-optimized IconItemRenderer and LabelItemRenderer

Optimizing MXML ItemRenderer

Optimizing MXML ItemRenderer


```
<s:ItemRenderer ...>
   <s:Rect left="0" right="0" top="0" bottom="0">
      <s:fill> <s:SolidColor color="0" alpha="0"/></s:fill>
   </s:Rect>

   <s:Line left="0" right="0" bottom="0" height="0">
      <s:stroke><s:SolidColorStroke .../></s:stroke>
   </s:Line>

   <s:HGroup verticalAlign="middle" left="15" right="15"
                          top="0" bottom="0" gap="10”>
      <s:BitmapImage id="icon" source="{data.graphic}” ... />
      <s:VGroup width="100%" height="100%" gap="12” ...>
          <s:RichText width="100%" text="{data.callLetters}"/>
          <s:RichText width="100%" text="{data.name}” .../>
      </s:Vgroup>
      <assets:Chevron/>
   </s:Hgroup>
</s:ItemRenderer>
```

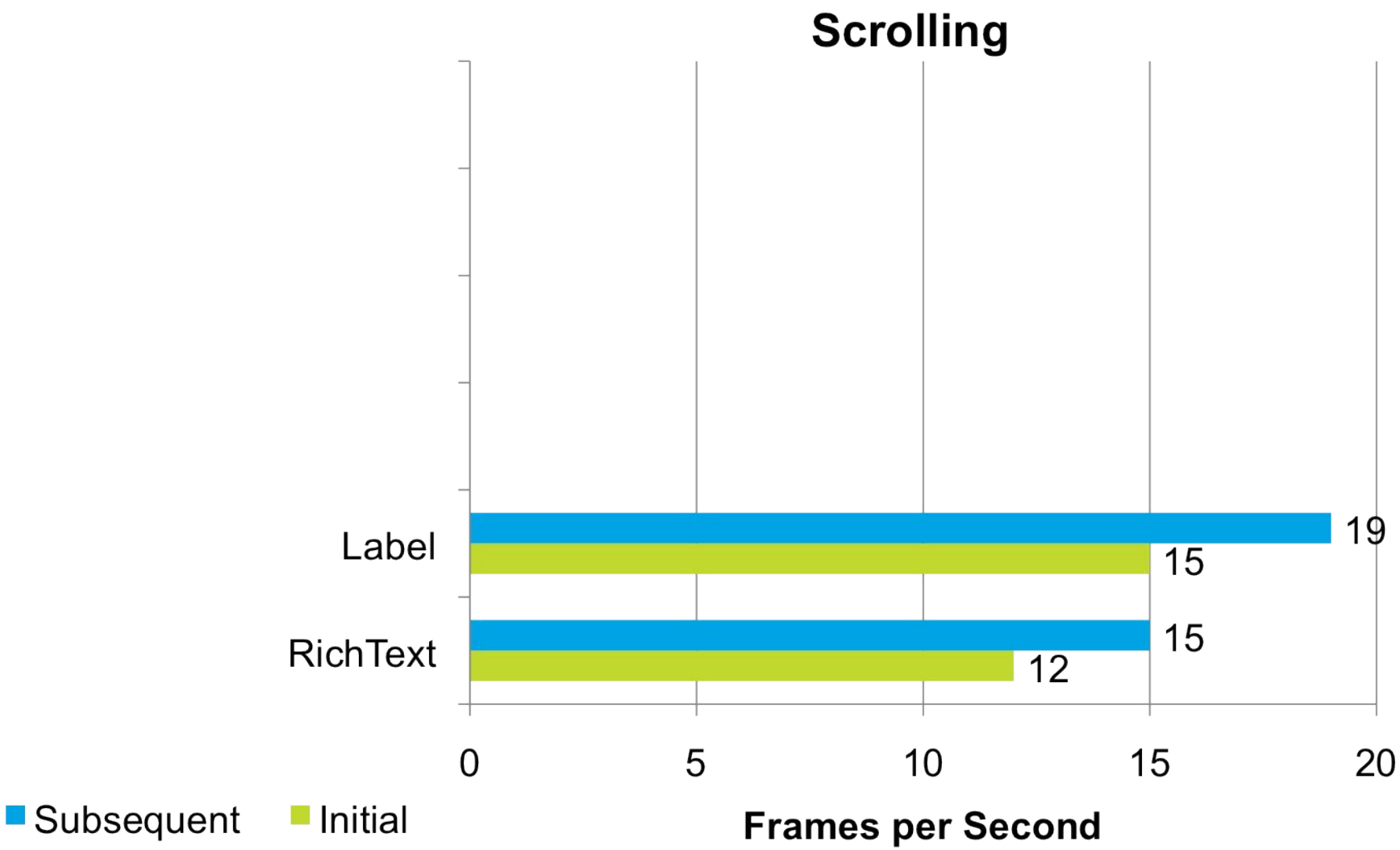
MXML ItemRenderer, Baseline Numbers



Replacing RichText with Label

```
<s:ItemRenderer ...>
   <!-- background fill -->
   <s:Rect ... />

   <!-- bottom separator -->
   <s:Line ... />

   <s:HGroup ...>

      <s:BitmapImage .../>

      <s:VGroup ...>
          <s:Label width="100%" text="{data.callLetters}"/>
          <s:Label width="100%" text="{data.name}" .../>
      </s:VGroup>

      <assets:Chevron/>
   </s:Hgroup>
</s:ItemRenderer>
```

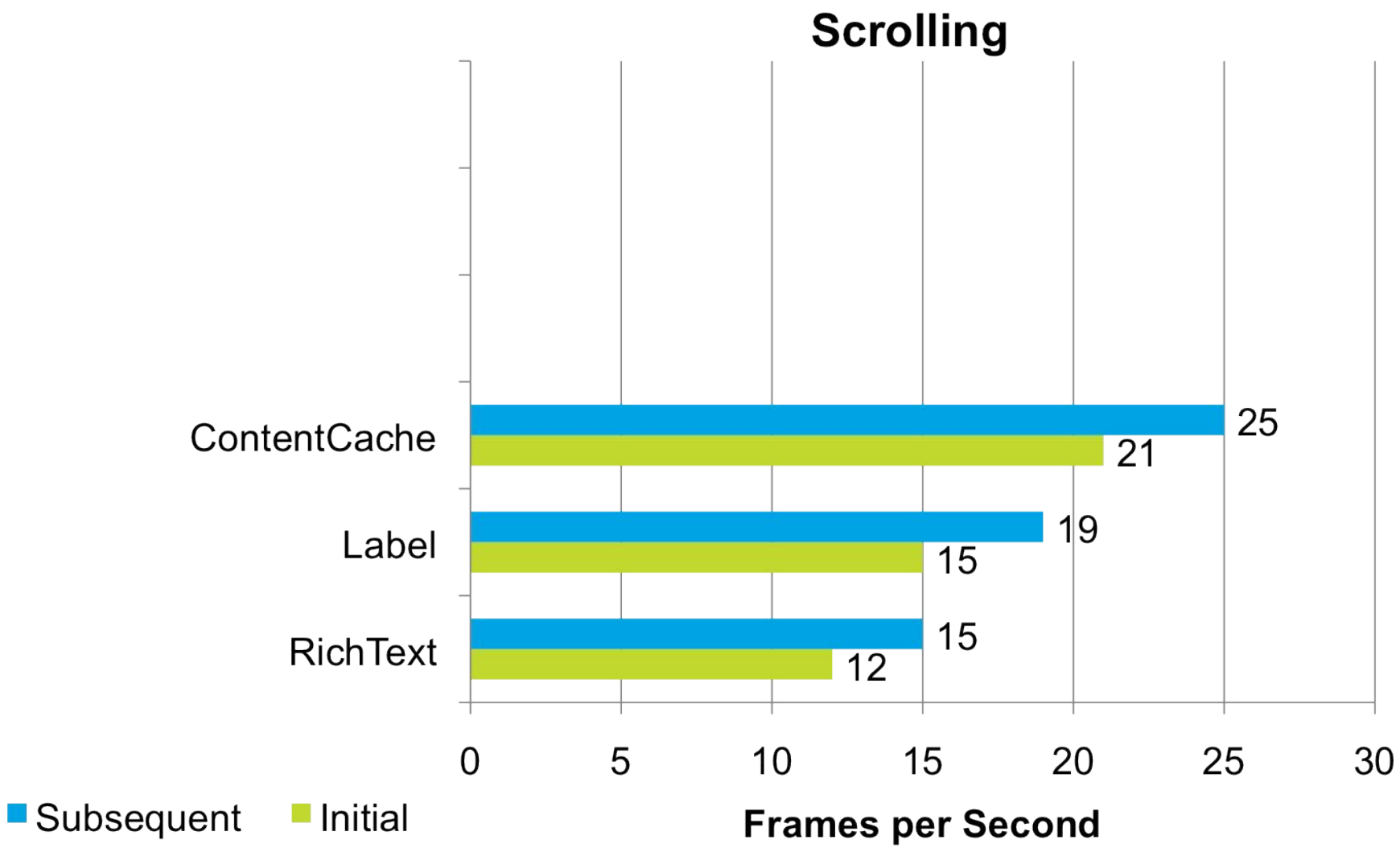
Replacing RichText with Label



Adding ContentCache

```
<s:ItemRenderer ...>
        <fx:Script>
        <![CDATA[
    import spark.core.ContentCache;
    static public const s_cache:ContentCache = new ContentCache();
          ]]>
    </fx:Script>

    <s:Rect ...
    <s:Line ...

    <s:HGroup ...>
       <s:BitmapImage id="icon" source="{data.graphic}”
                              contentLoader="{s_cache}"/>
       <s:VGroup ...>
          <s:Label .../>
          <s:Label ... />
       </s:Vgroup>
       <assets:Chevron/>
    </s:Hgroup>
</s:ItemRenderer>
```

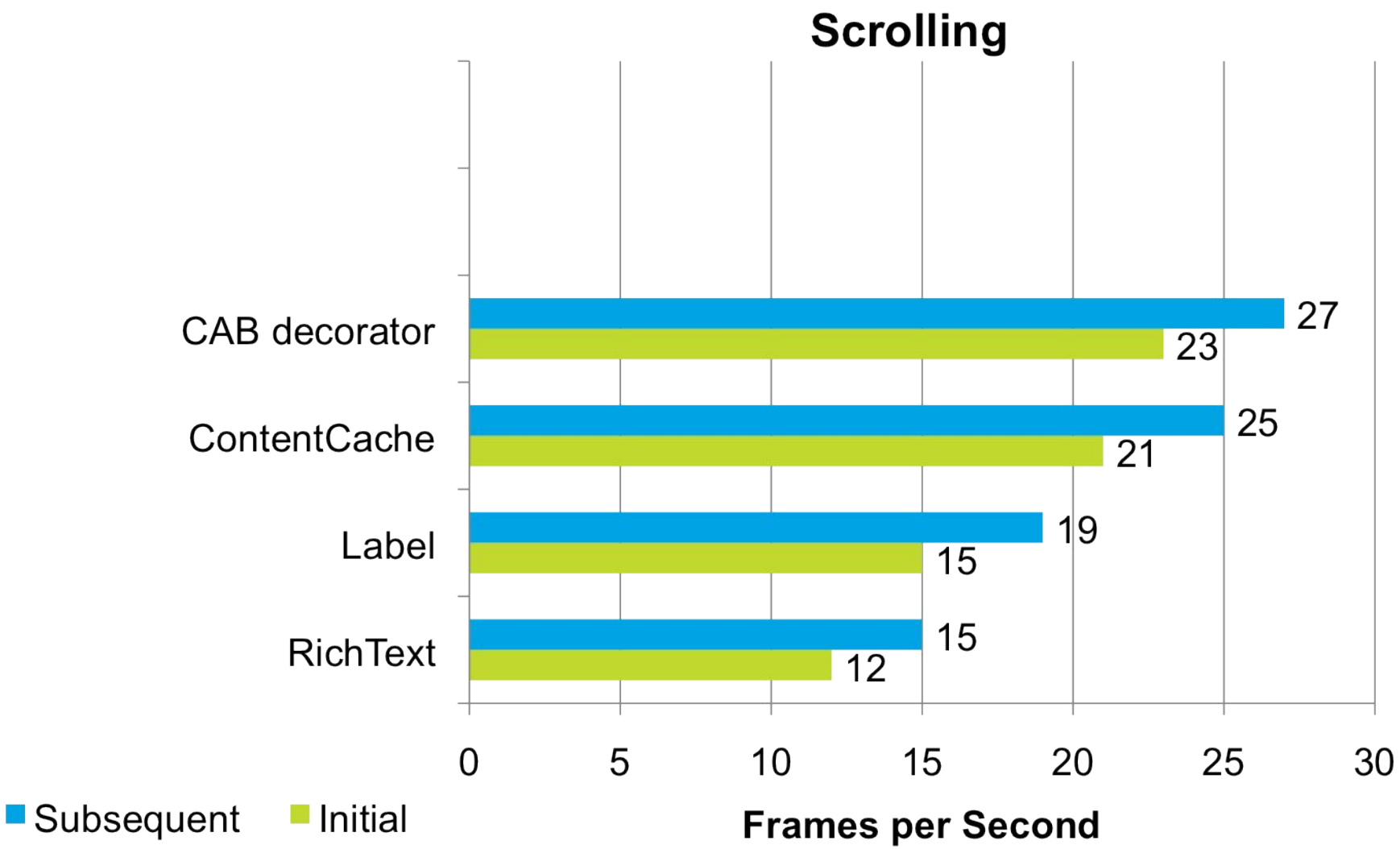
Adding ContentCache



Set “cacheAsBitmap” on the Decorator

```
<s:ItemRenderer ...>

      <fx:Script>
      <![CDATA[
         ...
      ]]>
   </fx:Script>

   <s:Rect ...
   <s:Line ...

   <s:HGroup ...>
      <s:BitmapImage .../>

      <s:VGroup ...>
         <s:Label .../>
         <s:Label ... />
      </s:VGroup>

      <assets:Chevron cacheAsBitmap="true"/>
   </s:HGroup>

</s:ItemRenderer>
```

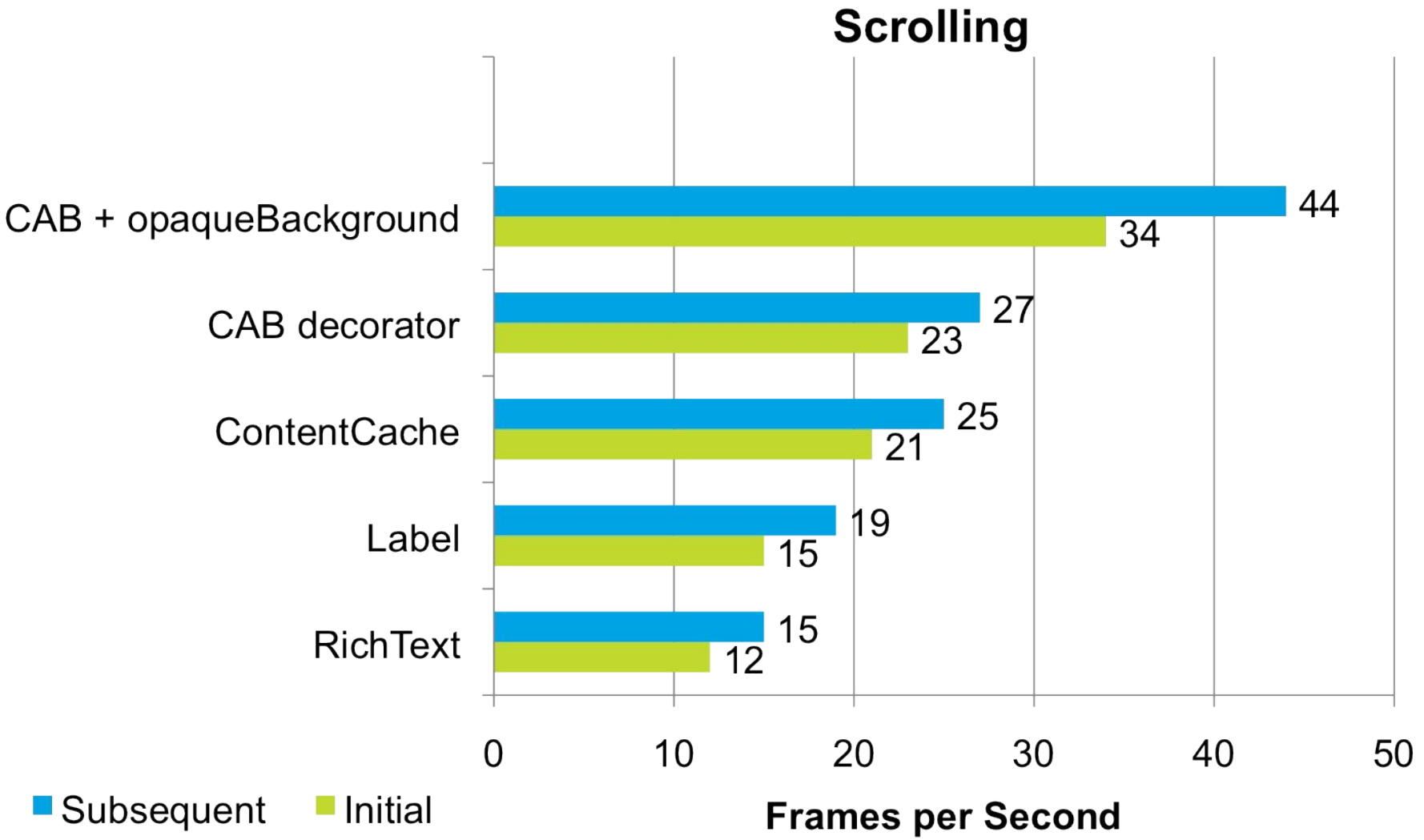
Set “cacheAsBitmap” on the Decorator



cacheAsBitmap + opaqueBackground on the ItemRenderer

```
<s:ItemRenderer ... opaqueBackground="0xFFFFFF" cacheAsBitmap="true">

    <fx:Script>
    <![CDATA[
        ...
    ]]>
  </fx:Script>

  <s:Rect ...
  <s:Line ...

  <s:HGroup ...>
    <s:BitmapImage .../>

    <s:VGroup ...>
      <s:Label .../>
      <s:Label ... />
    </s:VGroup>

    <assets:Chevron .../>
  </s:HGroup>

</s:ItemRenderer>
```

cacheAsBitmap + opaqueBackground on the ItemRenderer



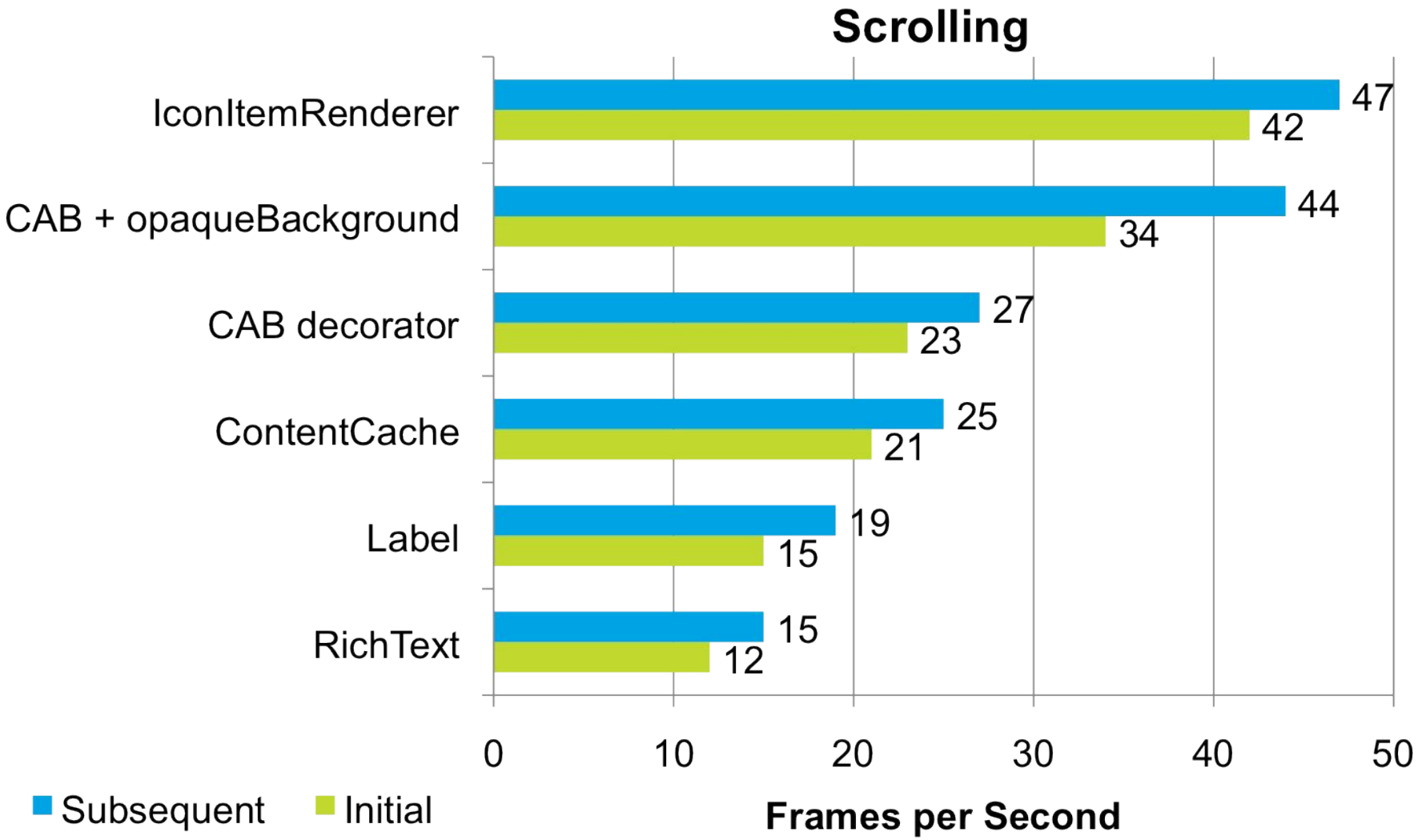
IconItemRenderer and LabelItemRenderer

- Optimized for Mobile
  - Use StylableTextField
  - Lightweight layout
  - Add more sophisticated ContentCache management
- Configurable
  - Use styles, properties to control the layout, text, etc.
- Extensible
  - Subclass to tweak layout, parts, etc.
  - Tip: Create parts on demand

IconItemRenderer

```
<s:List ...>
      <s:itemRenderer>
         <fx:Component>
            <s:IconItemRenderer labelField="callLetters"
                                messageField="name"
                                iconField="graphic"
                                iconWidth="48"
                                iconHeight="48"
                                decorator="{assets.Chevron}">
               <fx:Script>
                  <![CDATA[
                     import assets.Chevron;
                  ]]>
               </fx:Script>
                     </s:IconItemRenderer>
         </fx:Component>
      </s:itemRenderer>
</s:List>
```

IconItemRenderer

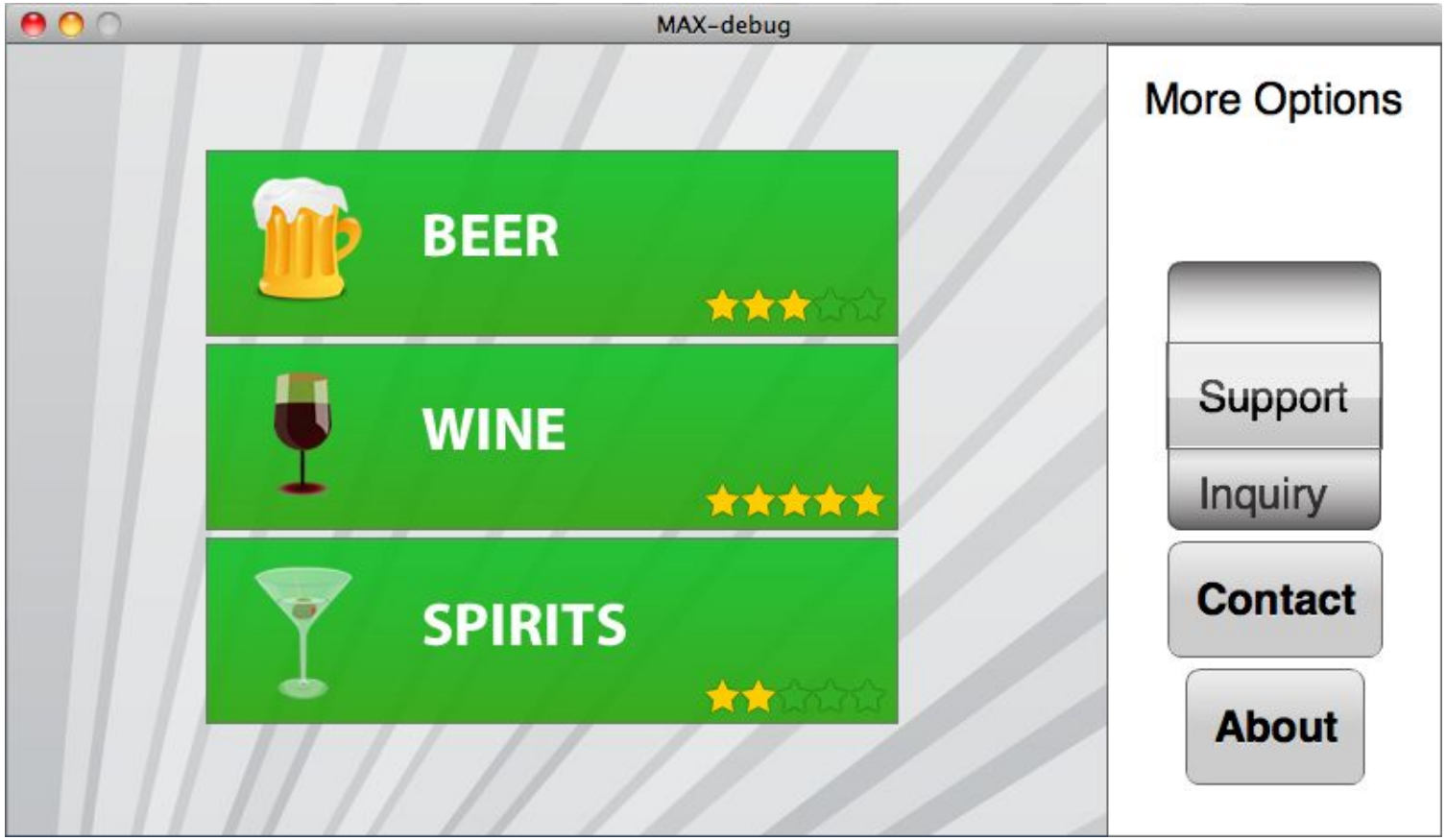


Views

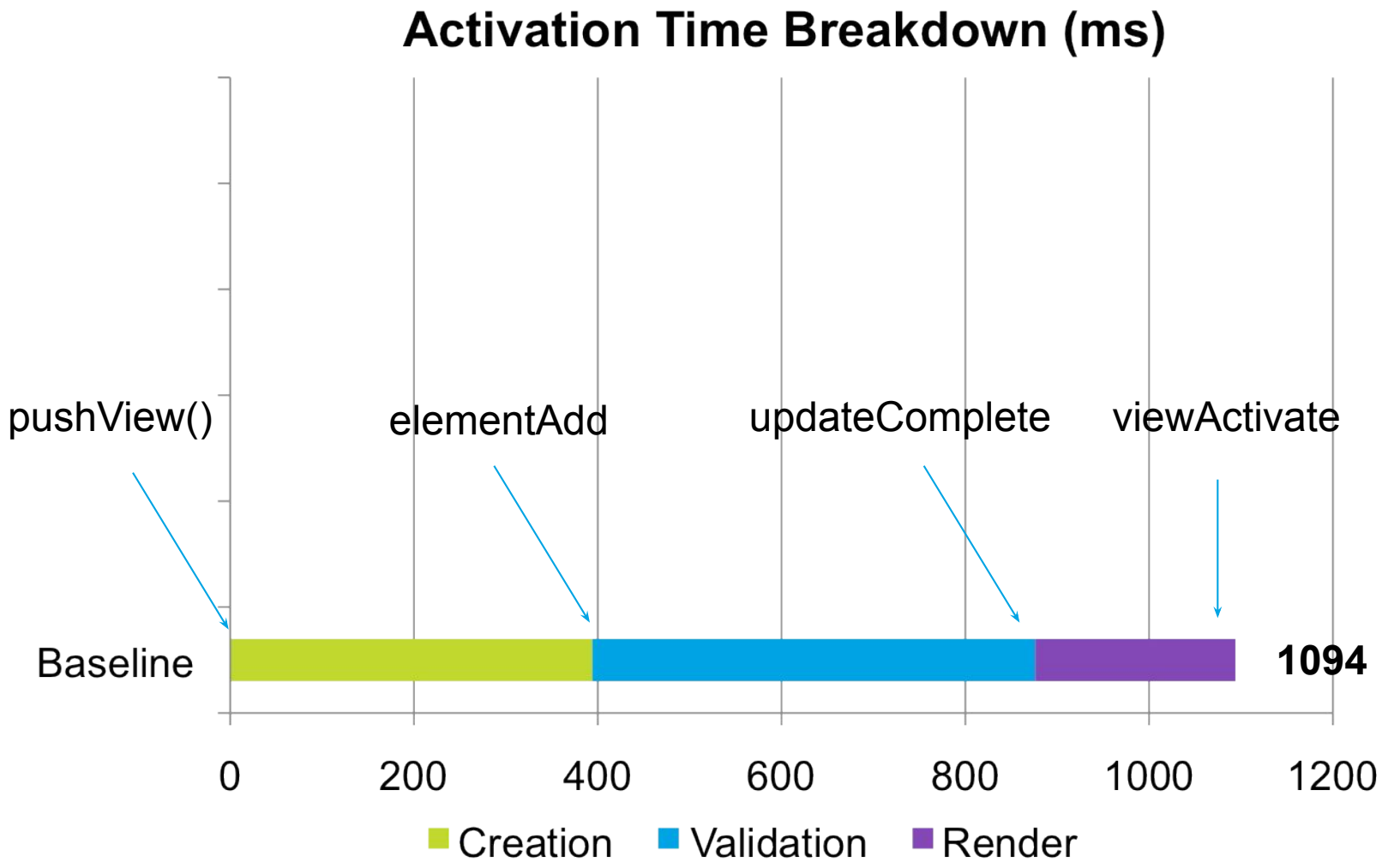
Views

- Creating Views in MXML is quick and simple
- Avoid creating heavy Views
  - Don’t use unnecessarily heavy (text) components
  - Defer object creation
  - Use BitmapImage instead of Image
  - Cache and queue external content requests
  - Use Group instead of BorderContainer
  - Reduce nested containers
  - Use mobile optimized component skins

Sample View



Baseline Results



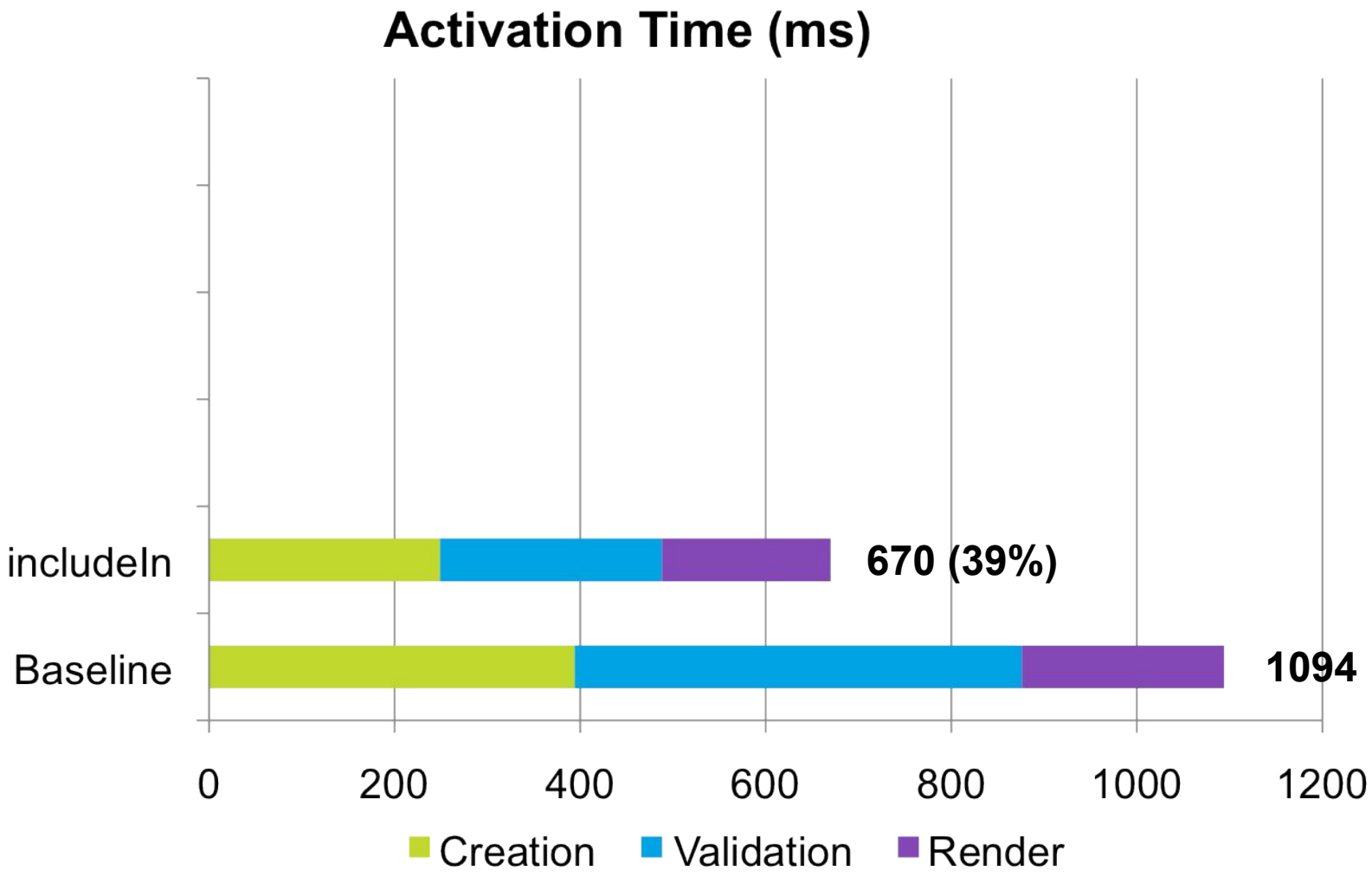
Deferred Instantiation

- Don’t create objects until needed

```
<s:Group id="helpView" height="100%"
        visible.portrait="false"
        includeInLayout.portrait="false">
  ...
<s:Group>
```

```
<s:Group id="helpView" height="100%"
        includeIn="landscape">
  ...
<s:Group>
```

Results



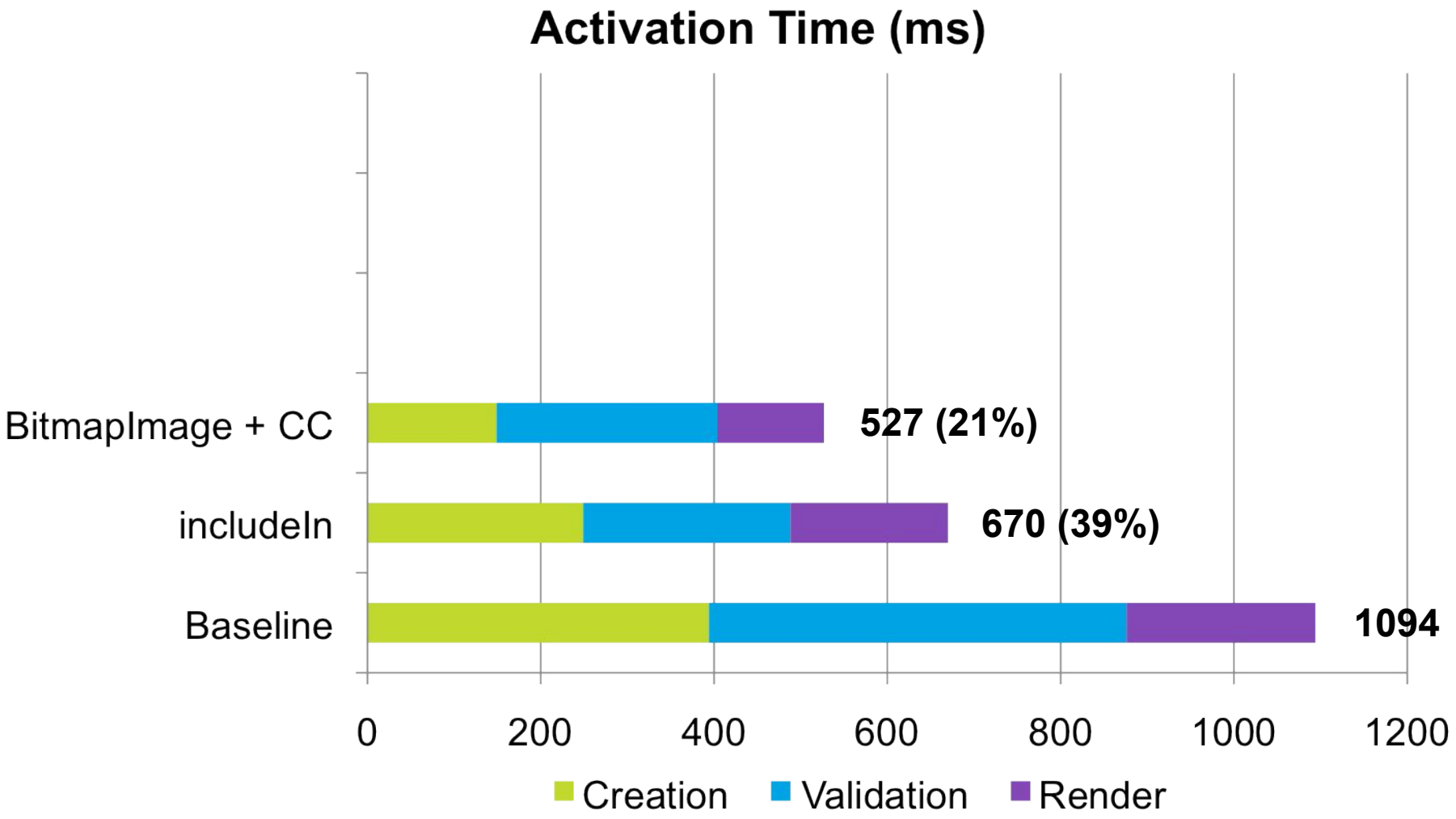
Convert Image to BitmapImage

- Spark Image
  - SkinnableComponent
  - Customizable loading state
  - Customizable “error” (broken image) state
- BitmapImage
  - Lightweight GraphicElement
- Cache images that are used frequently

Using ContentCache

```
<s:View ...>

    <fx:Script>
        <![CDATA[
            import spark.core.ContentCache;

            [Bindable]
            static protected var s_c:ContentCache = new ContentCache();
        ]]>
    </fx:Script>

    ...

    <s:BitmapImage source="star.jpg" contentLoader="{s_c}"/>

</s:View>
```

Results



BorderContainer

- BorderContainer is not optimized for mobile
- Instead use a Group with a Rect

```
<s:BorderContainer borderColor="red" width="100" height="100">
    <s:Button label="Play" />
</s:BorderContainer>
```

```
<s:Group width="100" height="100">
    <s:Rect top="0" left="0" right="0" bottom="0">
        <s:stroke>
            <s:SolidColorStroke color="red" />
        </s:stroke>
    </s:Rect>

    <s:Button label="Play" />
</s:Group>
```

Minimize Nested Groups

- Sometimes unnecessary nesting is easy to remove

```
<s:Group width="50" height="50">
    <s:Group width="100%" height="100%">
        <s:Button />
    </s:Group>
</s:Group>
```

```
<s:Group width="50" height="50">
    <s:Button />
</s:Group>
```

Using ConstraintLayout Instead of Nested Groups

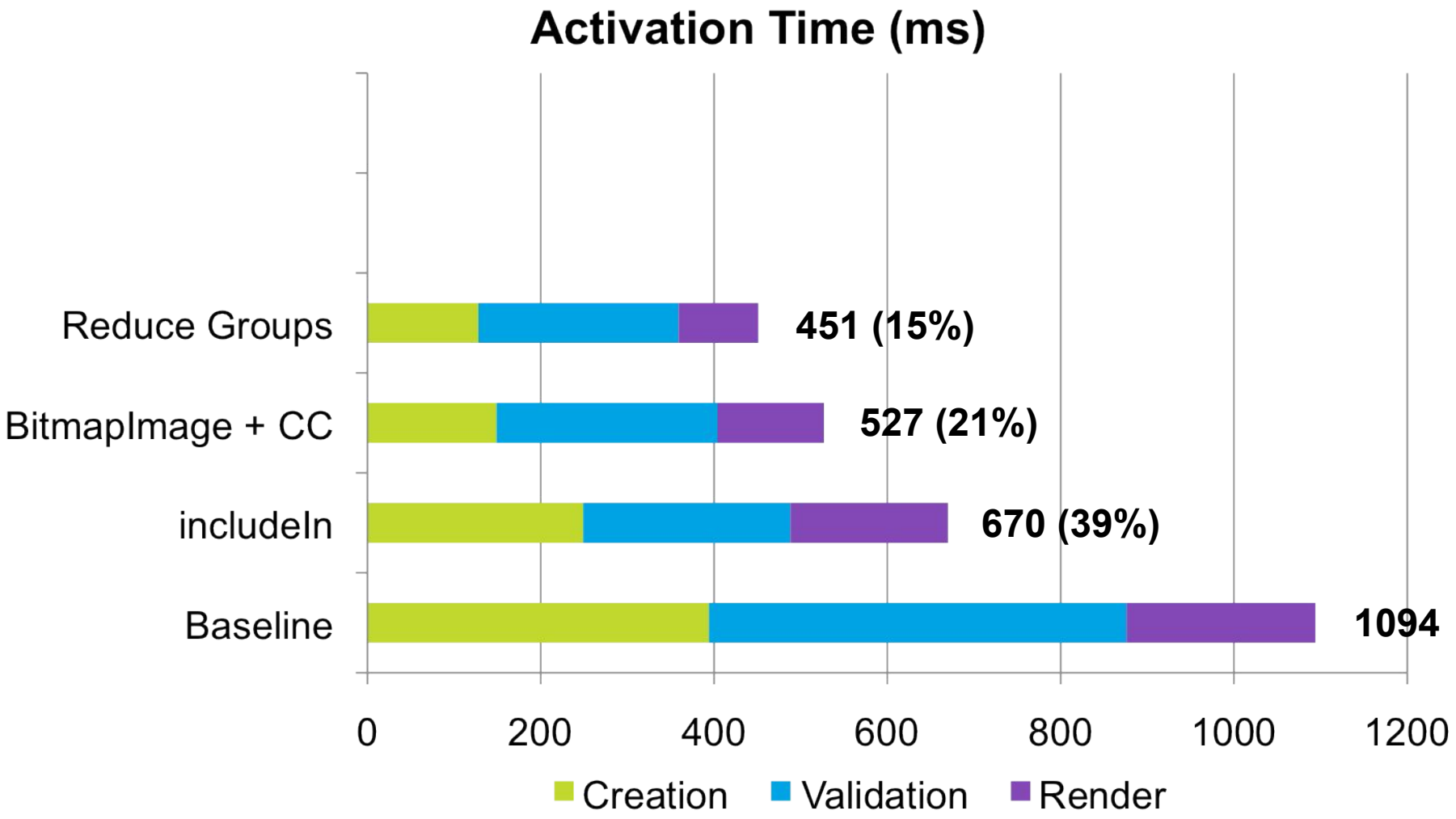
- Consider using ConstraintLayout instead of nested VGroup and HGroup

Using ConstraintLayout Instead of Nested Groups

Using ConstraintLayout Instead of Nested Groups

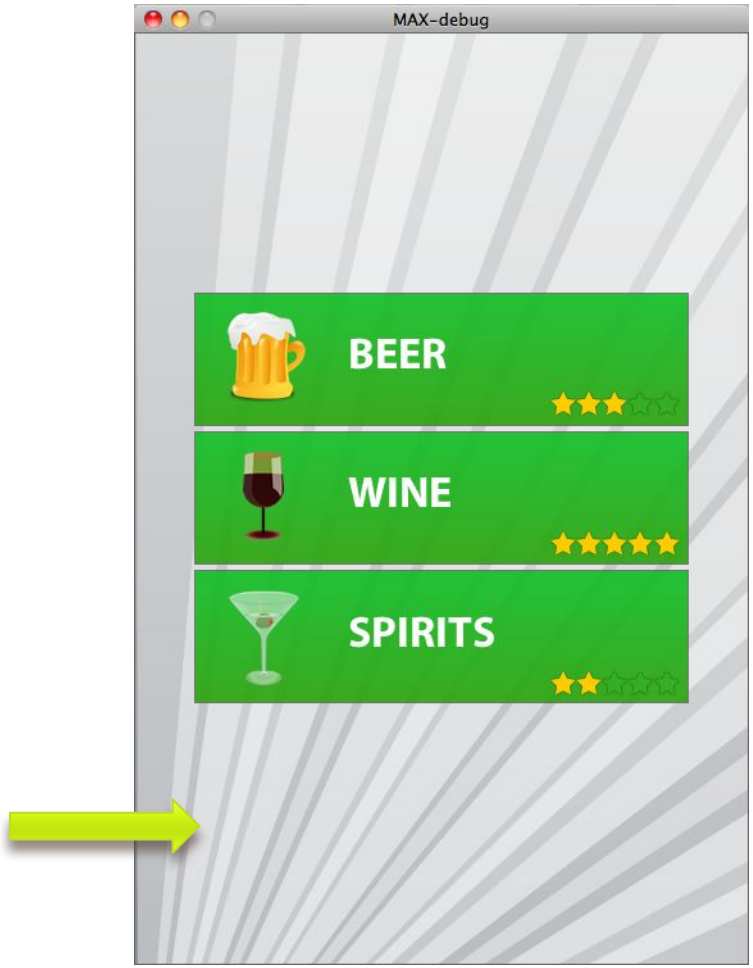
```
<s:Group width="100%" height="100%">
   <s:layout>
      <s:ConstraintLayout>
         <s:constraintColumns>
            <s:ConstraintColumn id="bmpColumn"/>
            <s:ConstraintColumn width="100%" id="contentColumn"/>
         </s:constraintColumns>
      </s:ConstraintLayout>
   </s:layout>

   <s:BitmapImage ...
                  left="bmpColumn:1" right="bmpColumn:1"
                  top="1" bottom="1"/>

   <s:Label text="Beer" top="21" left="contentColumn:25" />

</s:Group>
```

Results



Convert GraphicElements to FXG

- GraphicElements
  - Lightweight graphic primitives
- FXG
  - Static compile-time optimized graphics



Example of MXML GraphicElements

```
<s:Application xmlns:fx="http://ns.adobe.com/mxml/2009"
               xmlns:s="library://ns.adobe.com/flex/spark">

    <s:Button text="Hello World" x="150"/>

    <s:Rect id="myRect1" width="100" height="100">
        <s:fill><s:SolidColor color="#FF0000" /></s:fill>
    </s:Rect>

    <s:Rect id="myRect2" width="100" height="100" x="20" y="20">
        <s:fill><s:SolidColor color="#00FF00" /></s:fill>
    </s:Rect>

    <s:Rect id="myRect3" width="100" height="100" x="40" y="40">
        <s:fill><s:SolidColor color="#0000FF" /></s:fill>
    </s:Rect>

</s:Application>
```

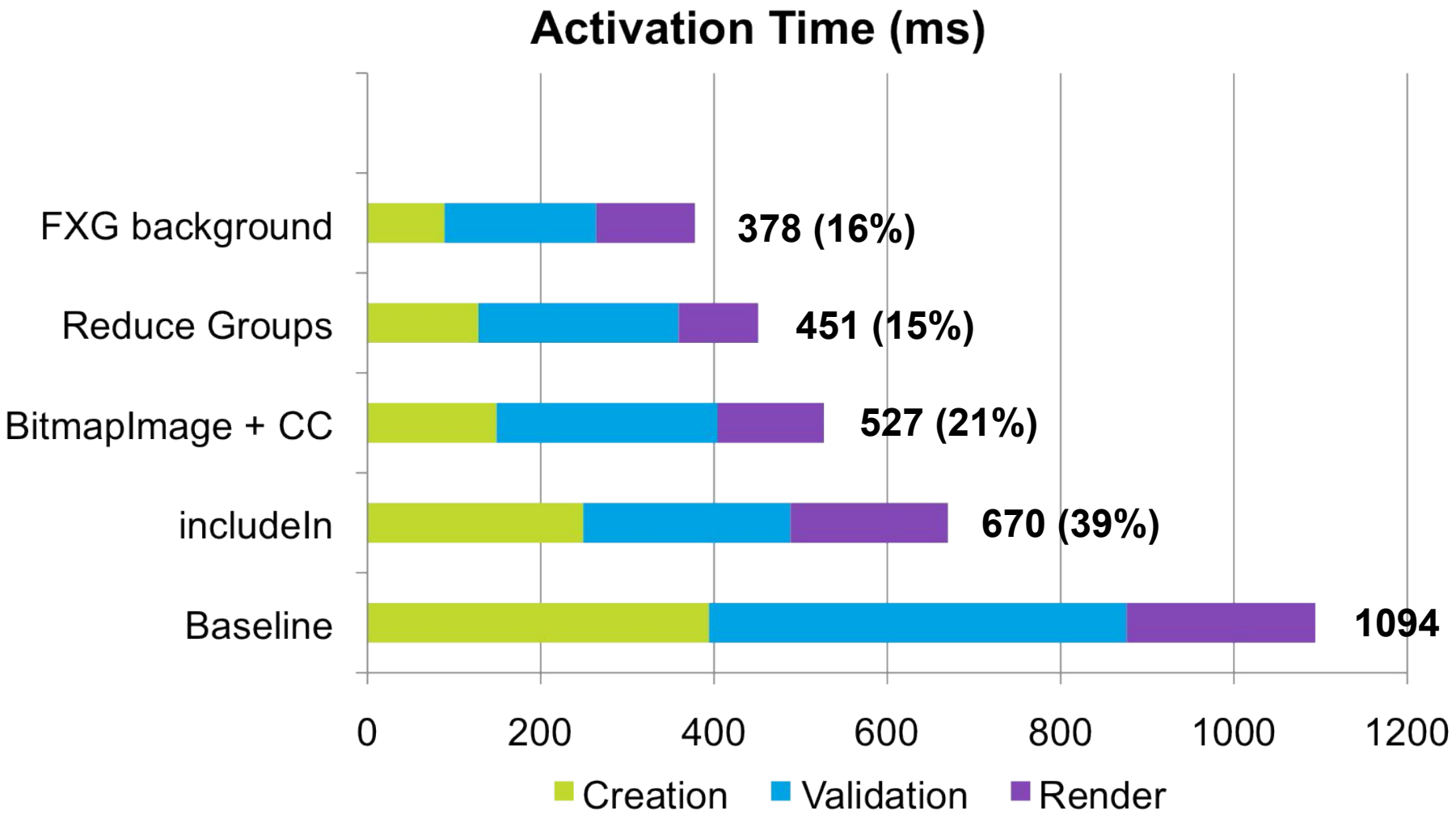
Example of Compiler Optimized FXG

```
<s:Application ...
   xmlns:assets="*">

   <s:Button
      text="Hello World"
      x="150" />

   <assets:MyGraphic />

</s:Application>
```

MyGraphic.fxg:

```
<Graphic xmlns="http://ns.adobe.com/fxg/2008">
   <Rect width="100" height="100">
      <fill>
         <SolidColor color="#FF0000" />
      </fill>
   </Rect>

   <Rect width="100" ... x="20" y="20">
      <fill>
         <SolidColor color="#00FF00" />
      </fill>
   </Rect>

   <Rect width="100" ... x="20" y="20">
      <fill>
         <SolidColor color="#0000FF" />
      </fill>
   </Rect>
</Graphic>
```

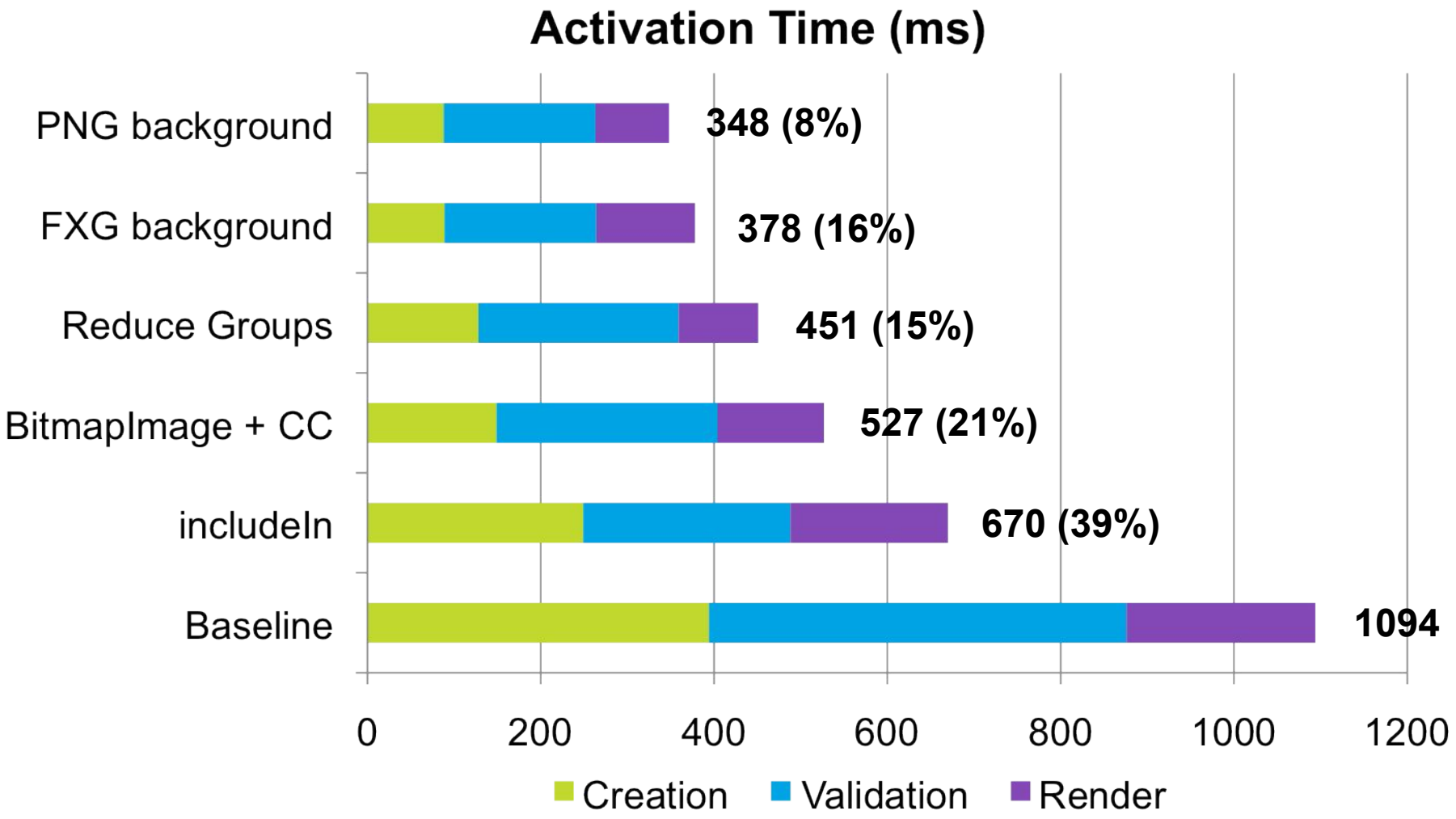
Results



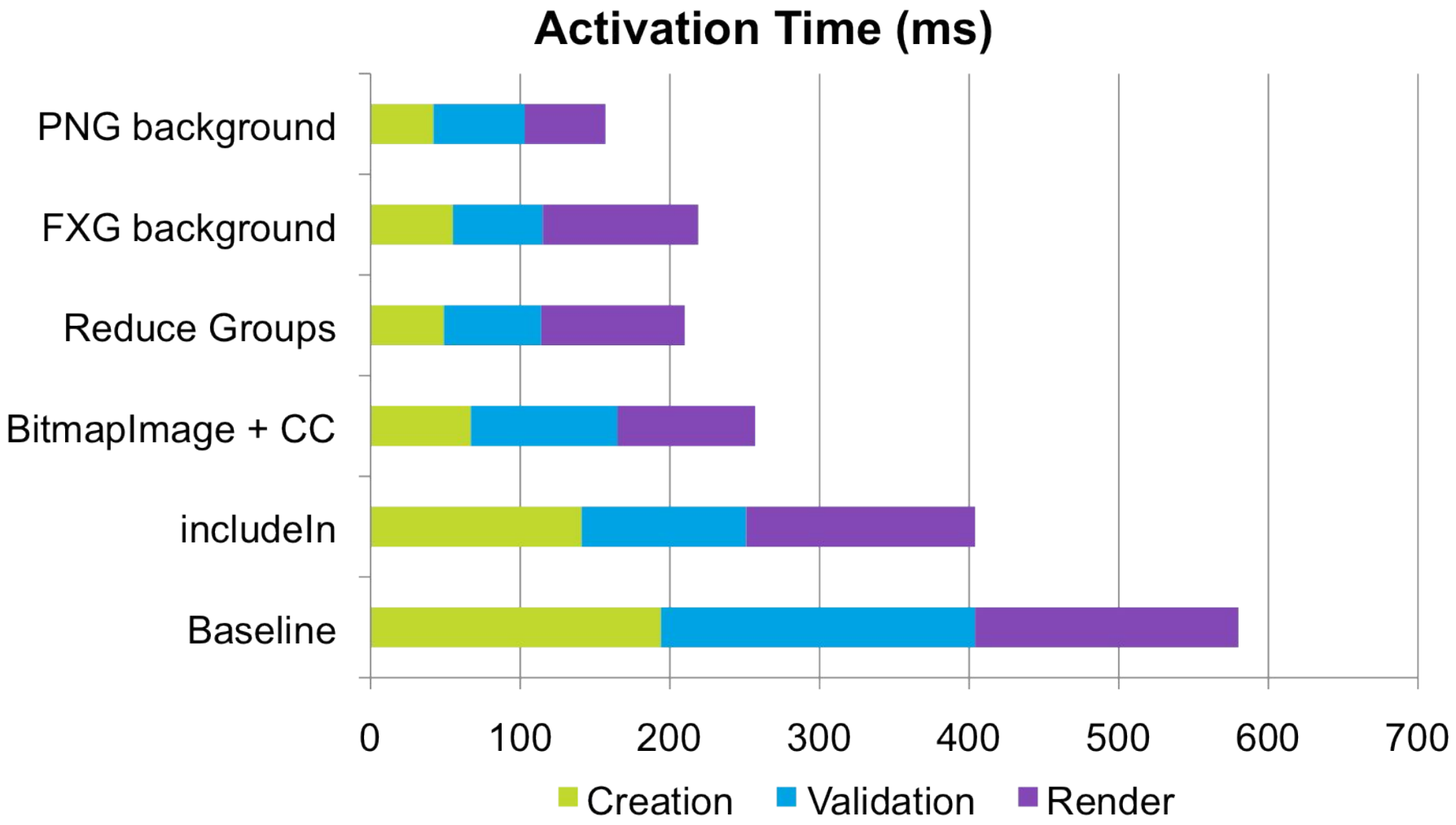
Convert FXG to PNG

- Consider converting complicated FXG shapes to bitmaps
- Reduce rendering time
- Lose scaling fidelity

Results



Results



Performance Optimizations in Flex 4.6

Scroller

- On demand scrollbars
  - Scrollbar skin parts are now factory parts
  - Created when touch interaction starts
  - Up to 15% faster for simple List views
  - Tip: Update custom Scroller skins
  - Tip: Use Scroller.viewport instead of Scroller.verticalScrollBar

```
trace(myScroller.verticalScrollBar.value);
```

```
trace(myScroller.viewport.verticalScrollPosition);
```

itemRendererFunction Recycles!

- Tip: Only create one ClassFactory per item renderer class

```
private function badIRFunction(item:Object):ClassFactory {
    if (Number(item) % 2 == 0)
        return new ClassFactory(RedRenderer);
    else
        return new ClassFactory(BlueRenderer);
}
```

```
private var red:ClassFactory = new ClassFactory(RedRenderer);
private var blue:ClassFactory = new ClassFactory(BlueRenderer);

private function goodIRFunction(item:Object):ClassFactory {
    if (Number(item) % 2 == 0)
        return red;
    else
        return blue;
}
```

32-bit Rendering in Android

- 32-bit rendering enables better color rendering, Stage3D, StageVideo
- 16-bit rendering has better scrolling performance
- Flash Builder 4.6 will automatically set this to 16-bit in new projects
- Existing projects should be updated

```
<android>
  <manifestAdditions>
    <![CDATA[
      <manifest android:installLocation="auto">
      <uses-permission android:name="android.permission.INTERNET"/>
      ...
      </manifest>
    ]]>
  </manifestAdditions>

  <colorDepth>16bit</colorDepth>
</android>
```

More Resources

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- Blogs
  - Evtim – http://www.evtimmy.com
  - Steve – http://www.flexponential.com
- Best Practices for Building Flex Tablet Applications – Glenn Ruehle, Flex SDK
- Flex Performance Tips & Tricks from 360Flex Denver 2011
  - http://flexponential.com/2011/04/20/flex-performance-tips-tricks/
- General Performance Tips from Adobe MAX 2010
  - http://2010.max.adobe.com/online/2010/MAX232_1288211035765KTXV
- IconItemRenderer and LabelItemRenderer
  - http://flexponential.com/tag/iconitemrenderer/

Adobe