AND110

ListViews and Adapters in Android

- Lecture will begin shortly
- Download class materials from university.xamarin.com

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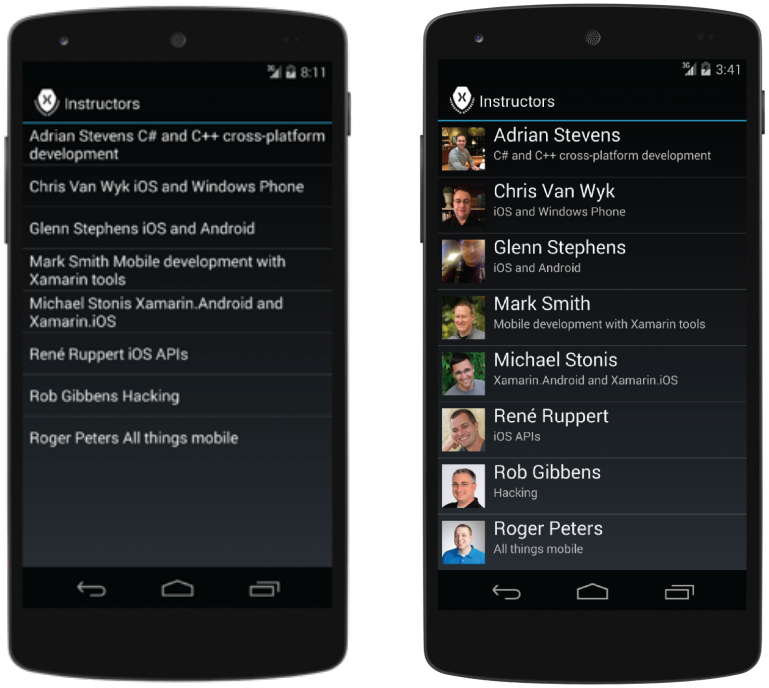
Objectives

1. Populate a **`ListView`** using an **`ArrayAdapter`**
2. Handle list-item click events
3. Implement a custom adapter
4. Use layout recycling and the view-holder pattern
5. Enable fast scrolling and code a section indexer



Populate a ListView using an ArrayAdapter

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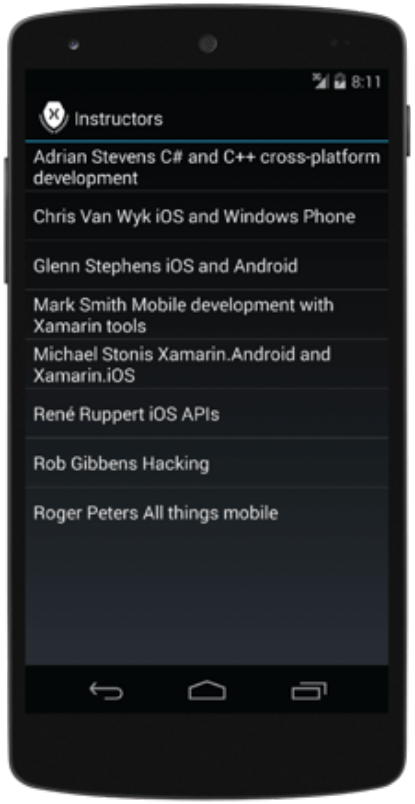
Tasks

1. Add a **`ListView`** to a UI
2. Use **`ArrayAdapter`** to populate a **`ListView`**
3. See the limitations of **`ArrayAdapter`**



What is a ListView?

- `ListView` displays a data collection as a sequence of visual rows

Rows can be simple strings or complex layouts with many views

What is an Adapter?

- An **`Adapter`** is a class that creates and populates the rows in a **`ListView`**

```
var l = new List<Instructor>();
l.Add(new Instructor() { ... });
l.Add(new Instructor() { ... });
l.Add(new Instructor() { ... });
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```

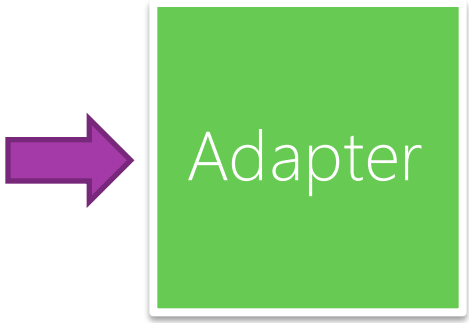

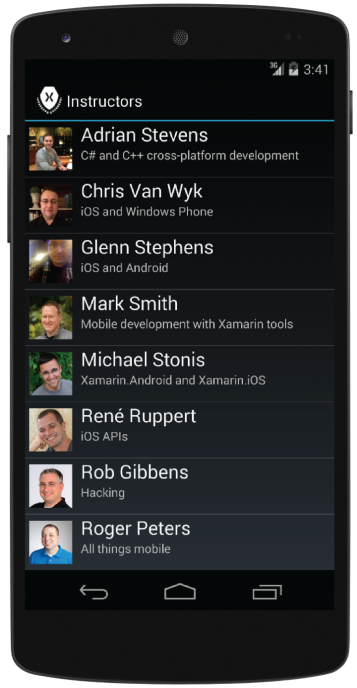

This Adapter creates each row with an image and two pieces of text

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What is an ArrayAdapter?

- **`ArrayAdapter`** is a built-in adapter that populates a row using only a single string from your data

```
var l = new List<Instructor>();
l.Add(new Instructor() { ... });
l.Add(new Instructor() { ... });
l.Add(new Instructor() { ... });
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```
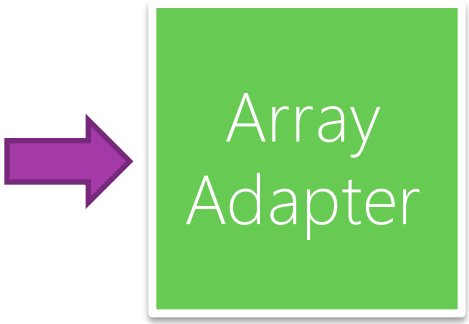
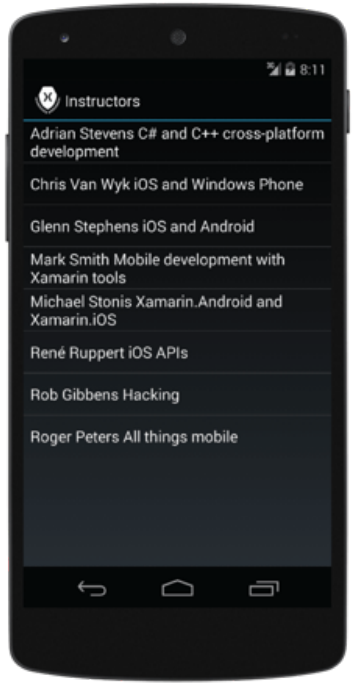



Calls **`ToString`** on the **`Instructor`** and uses it to populate a **`TextView`**



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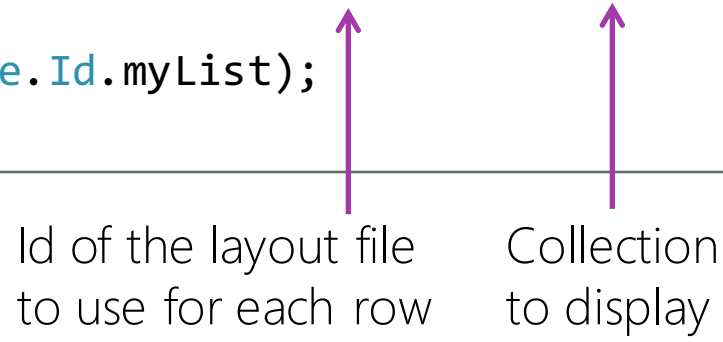
How to Use ArrayAdapter

- **`ArrayAdapter`** needs a layout file with a **`TextView`** and a data collection

```
var data = new List<Instructor>();
...

var adapter = new ArrayAdapter<Instructor>(this, layoutFileId, data);

var list = FindViewById<ListView>(Resource.Id.myList);
list.Adapter = adapter;
```



Individual Exercise

Populate a ListView using an ArrayAdapter

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Flash Quiz

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Flash Quiz

① How are the rows in a **`ListView`** created?

a) The **`ListView`** creates them using a Data Template

b) The **`ListView`** asks the Adapter for each row as needed

c) Rows are always strings so there is no need to create them

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Flash Quiz

① How are the rows in a **`ListView`** created?

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b) The **`ListView`** asks the Adapter for each row as needed

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Flash Quiz

② What is the key limitation of the standard `ArrayAdapter` implementation?

a) Data objects must be in an array

b) The rows it builds do not support `ItemClick` events

c) It can only populate one `TextView`

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Flash Quiz

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Flash Quiz

③ How does **`ArrayAdapter`** convert the code-behind data into a string?

a) Calls **`ToString`**

b) Serializes the object to XML

c) Uses reflection to get the first string property in the object

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Flash Quiz

③ How does **`ArrayAdapter`** convert the code-behind data into a string?

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Summary

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2. Use **`ArrayAdapter`** to populate a **`ListView`**
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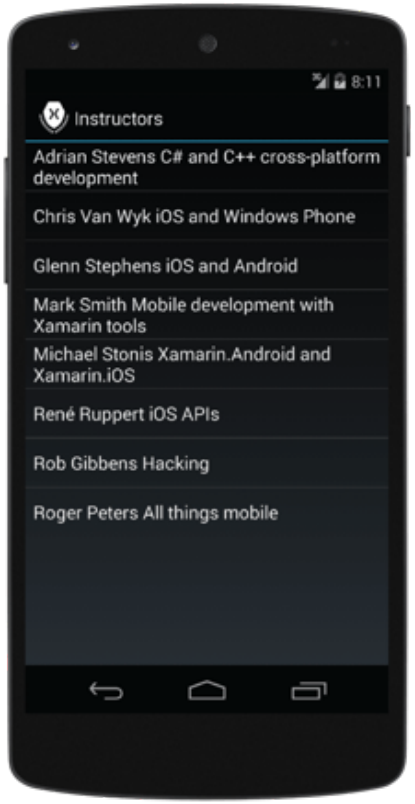
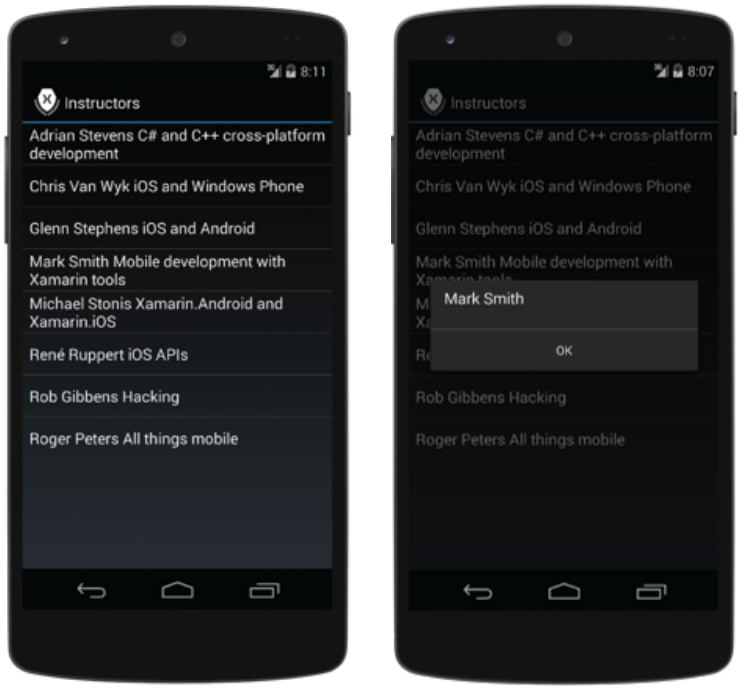


Handle list-item click events

Tasks

1. Subscribe to the `ListView.ItemClick` event
2. Determine which list items was clicked



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How to Handle ItemClick

- Subscribe to **`ListView.ItemClick`** to respond to user clicks

```
var l = FindViewById<ListView>(Resource.Id.myList);

l.ItemClick += OnItemClick;
```

```
void OnItemClick(object sender, AdapterView.ItemClickEventArgs e)
{
  var position = e.Position;
  ...
}
```

Event args contain the position of the clicked item

Individual Exercise

Handle list-item click events

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Summary

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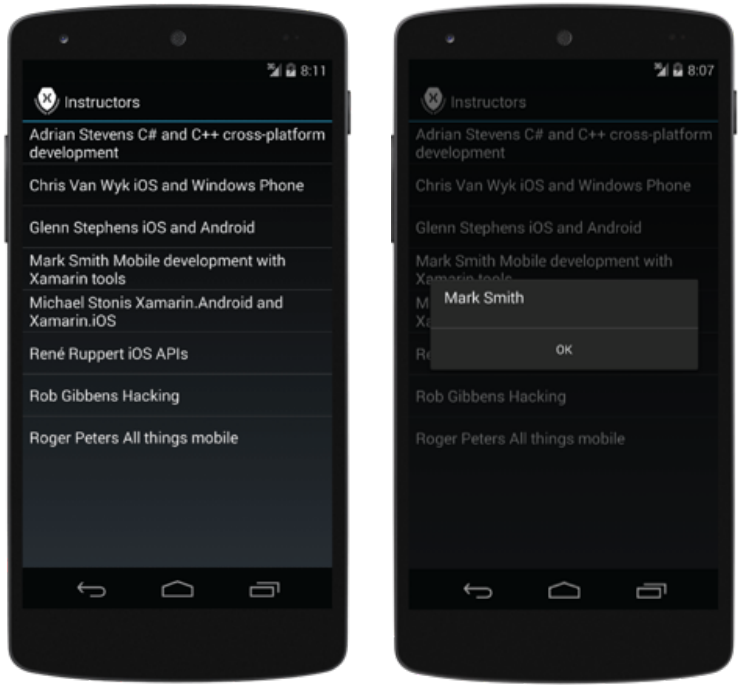

Implement a custom adapter

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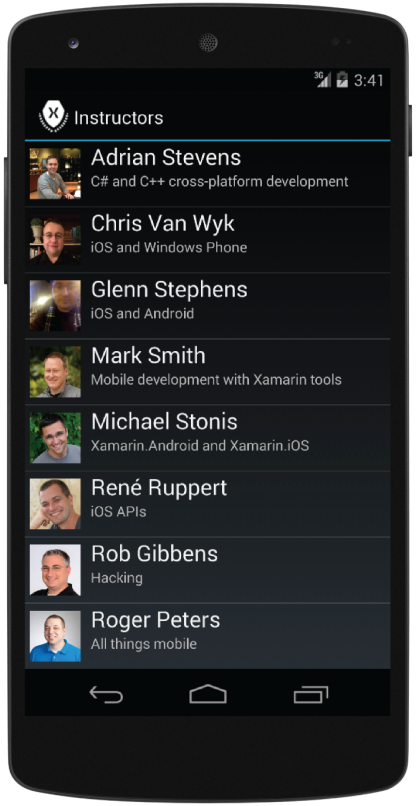
Tasks

1. Why build a custom adapter?
2. Inflate a layout file with `LayoutInflater`
3. Code a custom Adapter



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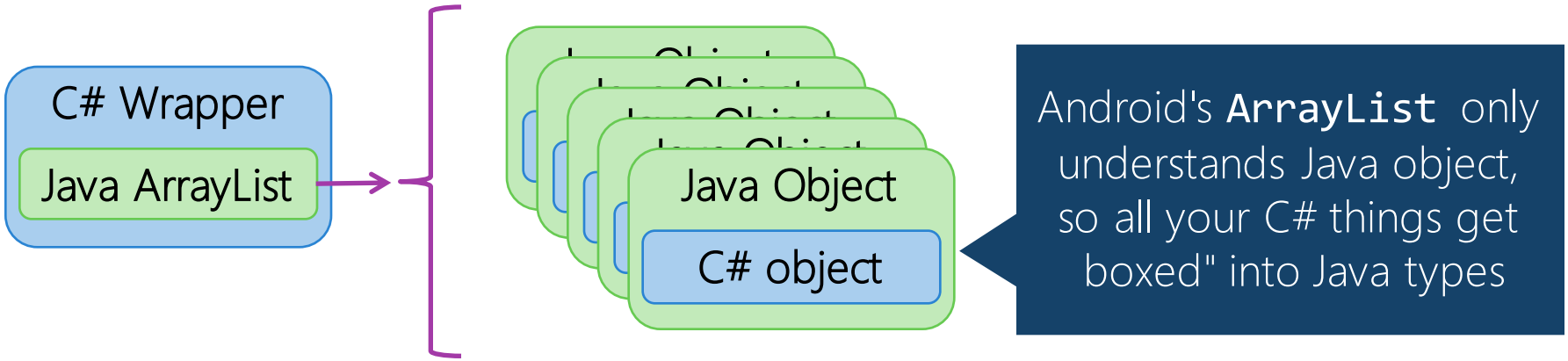
Why build a custom adapter?

- **`ArrayAdapter`** is fine for small views of data, but inefficient when dealing with more than a page or two because it's built around Java objects



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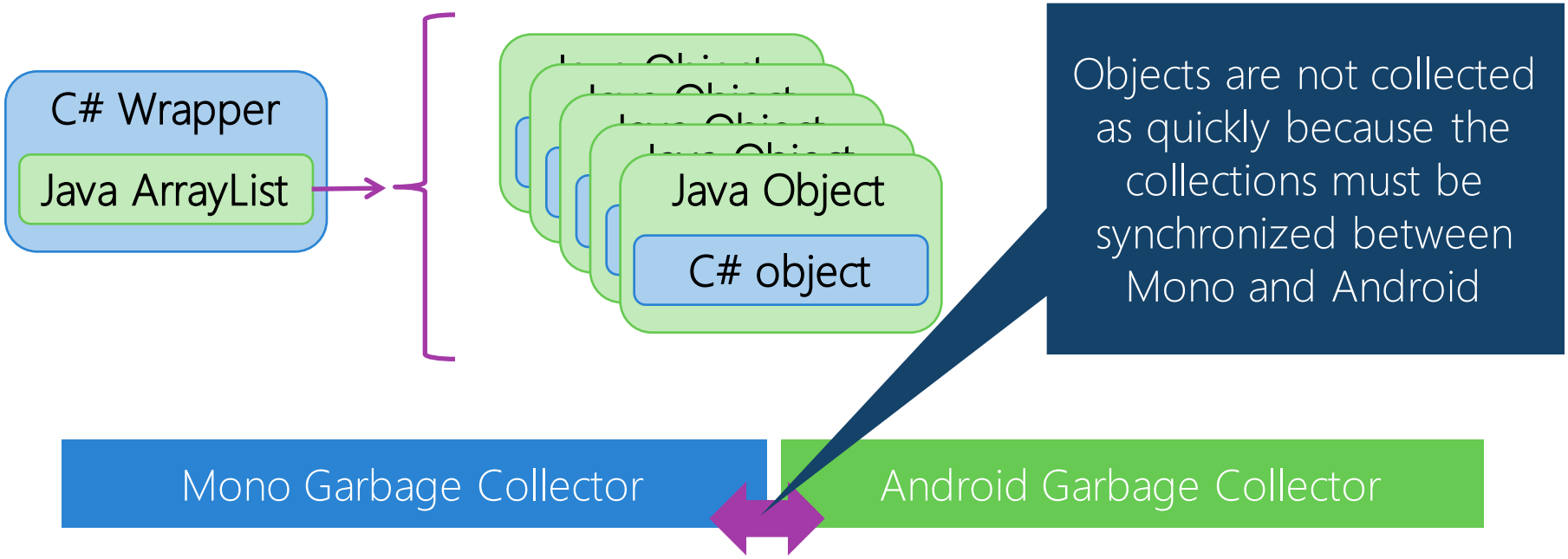

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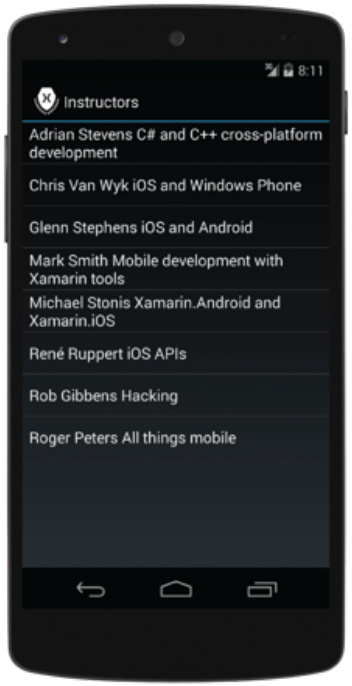
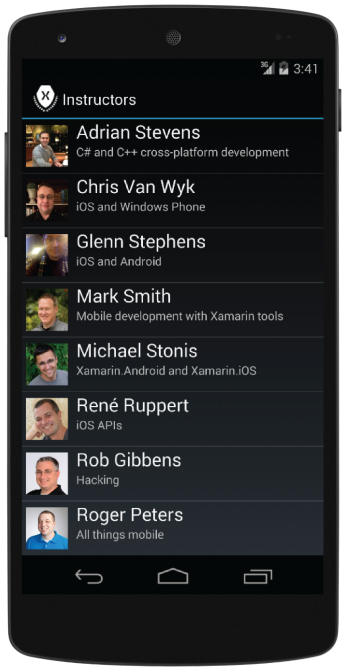
Why build a custom adapter?

- **`ArrayAdapter`** can only generate text-based rows for the **`ListView`**

I get this:



But want this:



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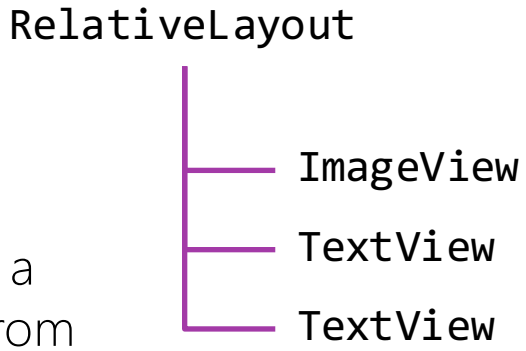
What is Inflation?

- *Inflation* is the process of instantiating the contents of a layout file

```
<RelativeLayout ... >
  <ImageView ... />
  <TextView  ... />
  <TextView  ... />
</RelativeLayout ... >
```

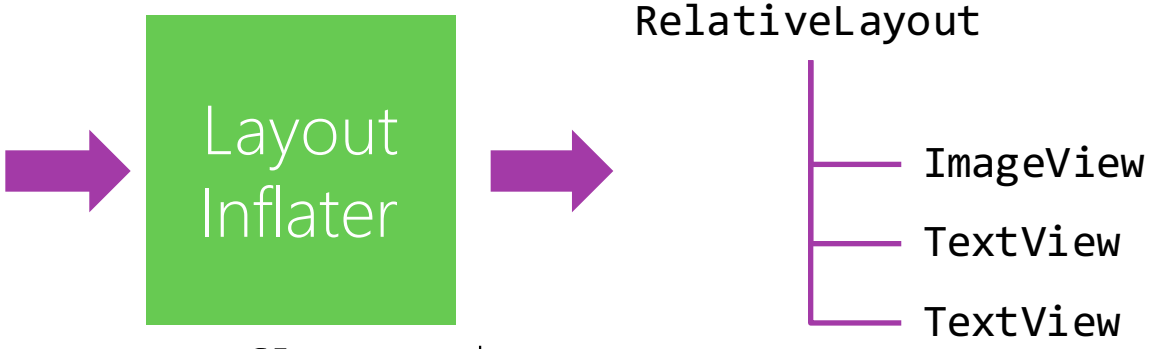
Inflation creates a view hierarchy from a layout file



What is a LayoutInflater?

- Library class **`LayoutInflater`** performs inflation

```
<RelativeLayout ... >
  <ImageView ... />
  <TextView  ... />
  <TextView  ... />
</RelativeLayout ... >
```



`LayoutInflater` takes a resource file id and returns a **`View`** hierarchy

Android uses the spelling *inflater* rather than *inflator* and we will follow that convention.

Inflater access

- Your adapter needs an *inflater*, it is typical to use the parent view passed to your adapter's **`GetView`** method

The **`ViewGroup`** that will contain your inflated layout

```
public override View GetView(int position, View convertView, ViewGroup parent)
{
  var inflater = LayoutInflater.From(parent.Context);
  ...
}
```

Android allows you to get a **`LayoutInflater`** from a **`Context`**

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What is BaseAdapter<T>?

- `BaseAdapter<T>` is a base class for custom adapters, it declares the four methods every Adapter must provide

```
public abstract class BaseAdapter<T> : BaseAdapter
{ ...
  public abstract View GetView(int position, View convertView, ViewGroup parent);

  public abstract T this[int position] { get; }
  public abstract int  Count { get; }
  public abstract long GetItemId(int position);
}
```

Generate a row

Information about the collection

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What is IListAdapter?

- `ListView` expects an `IListAdapter` (which extends `IAdapter`) to turn data into Android views

- This is what `ArrayAdapter` and `BaseAdapter<T>` implement

```
class MyAdapter :
      TrainerDb, IListAdapter
{
   public View GetView(...) {
     ...
   }
   ...
}
```

Can implement this directly to combine data provider and adapter into a single class

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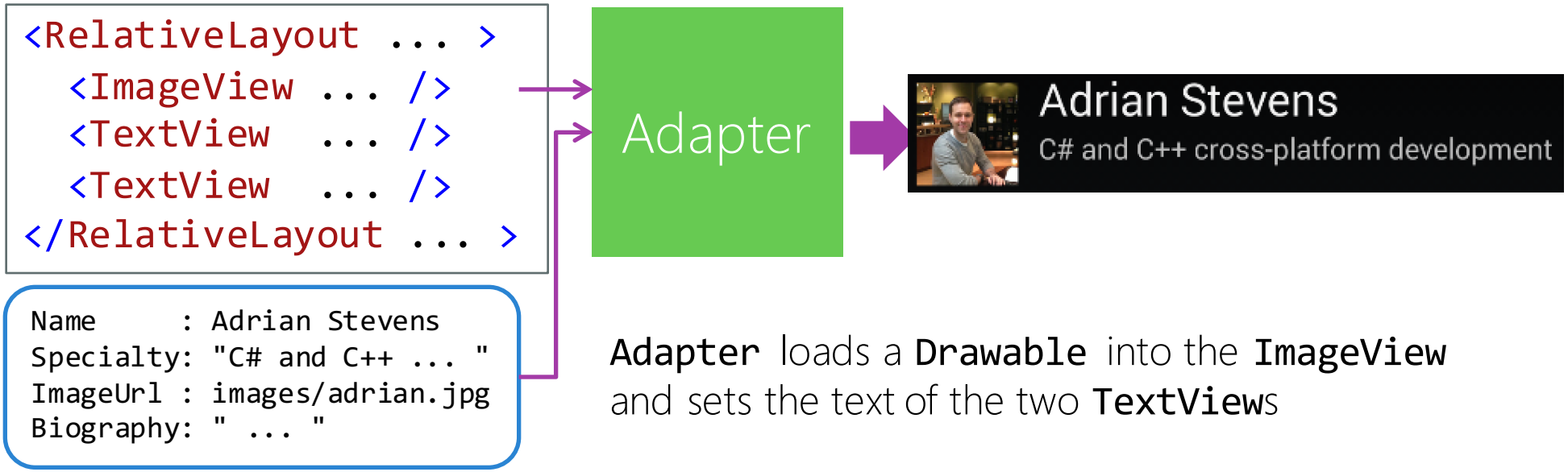
How to code GetView

- **`GetView`** produces a row by inflating a layout file and populating the views with code-behind data



`Adapter` loads a **`Drawable`** into the **`ImageView`** and sets the text of the two **`TextViews`**

Individual Exercise

Implement a custom adapter

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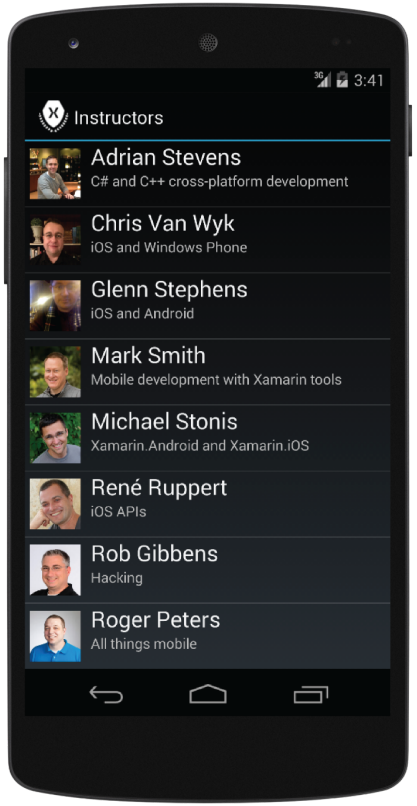
Summary

1. Why build a custom adapter?
2. Inflate a layout file with `LayoutInflater`
3. Code a custom Adapter



Use layout recycling and the view-holder pattern

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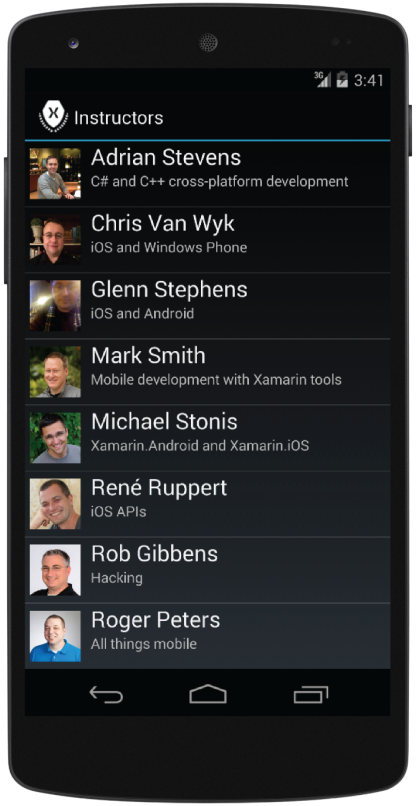
Tasks

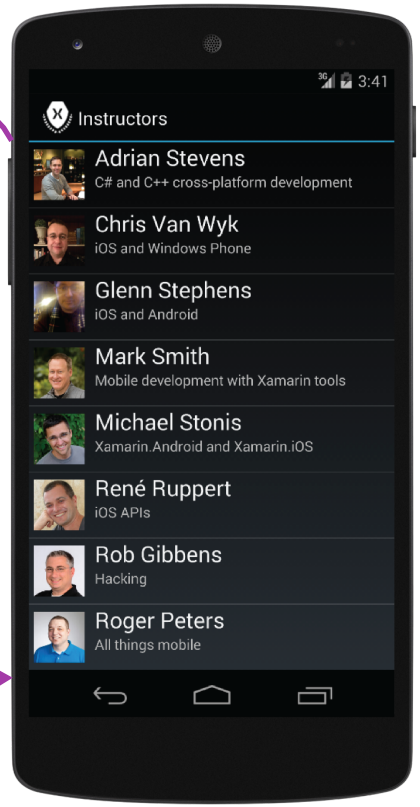
1. Reuse inflated layouts to reduce memory usage
2. Cache view references to increase performance



ListView Layout Reuse

- `ListView` maintains populated layouts only for rows that are visible to the user, non-visible layouts are recycled

As user scrolls down, the top layout is no longer needed, it is passed to `GetView` to be refilled with new data and added at bottom



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How to Reuse Inflated Layouts

- **`GetView`** will receive a layout in **`convertView`** to reuse if one is available

```
public override View GetView(int position, View convertView, ViewGroup parent)
{
  var view = convertView;

  if (view == null)
  {
    view = context.LayoutInflater.Inflate(... );
  }
  ...
}
```

Only inflate a new layout if **`ConvertView`** is **`null`**

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What is View.Tag?

- **`View`** has a **`Tag`** property you can use to store any extra info you need

```
public class View : ...
{
  public virtual Java.Lang.Object Tag { get; set; }
  ...
}
```

Your data must inherit from Java's **`Object`** base class

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What is a View Holder?

- **`ViewHolder`** is the traditional name for a class that contains cached view references

```
public class ViewHolder : Java.Lang.Object
{
  public ImageView Photo     { get; set; }
  public TextView  Name      { get; set; }
  public TextView  Specialty { get; set; }
}
```

Inherits from Java's object so it can be stored in **`View.Tag`**

One property per view

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How to Cache View References

- Cache view references in the layout's **Tag** so you only find references once when the layout is inflated, not each time the layout is reused

```
public override View GetView(int position, View convertView, ViewGroup parent)
{ ...
  view = context.LayoutInflater.Inflate(...);

  var p = view.FindViewById<ImageView>(Resource.Id.photoImageView);
  var n = view.FindViewById<TextView >(Resource.Id.nameTextView);
  var s = view.FindViewById<TextView >(Resource.Id.specialtyTextView);

  view.Tag = new ViewHolder() { Photo = p, Name = n, Specialty = s };
  ...
}
```

Cache the reference during creation of the layout

Individual Exercise

Use layout recycling and the view-holder pattern

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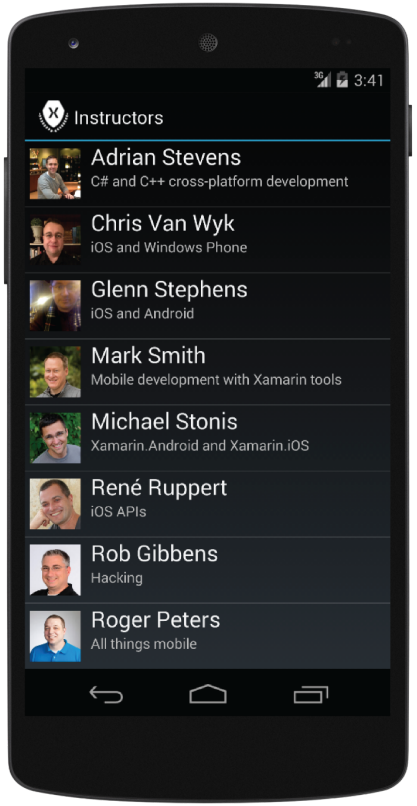
Summary

1. Reuse inflated layouts to reduce memory usage
2. Cache view references to increase performance



Enable fast scrolling and code a section indexer

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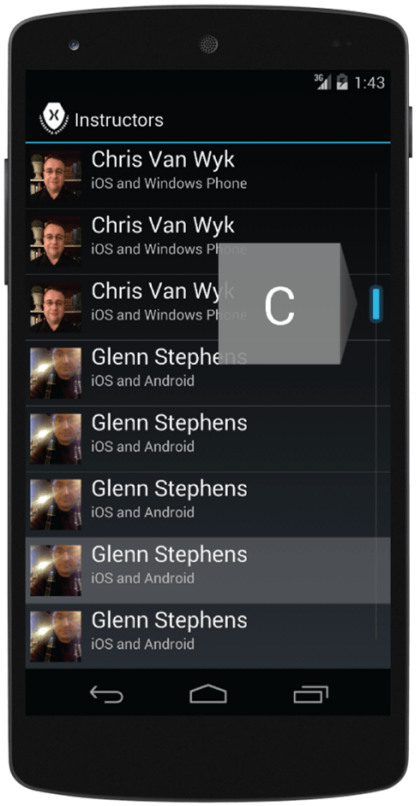
Tasks

1. Enable `ListView` fast scrolling
2. Implement `ISectionIndexer` on a custom Adapter



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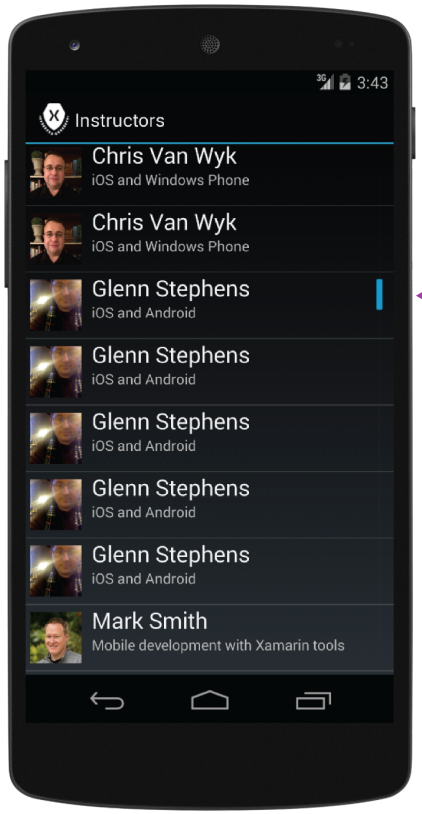
How to Enable Fast Scrolling

- Set the `ListView`'s `FastScrollEnabled` property to `true` to turn on fast scrolling



User can drag the *thumb* to scroll quickly (thumb only appears when the list contains multiple screens of data)

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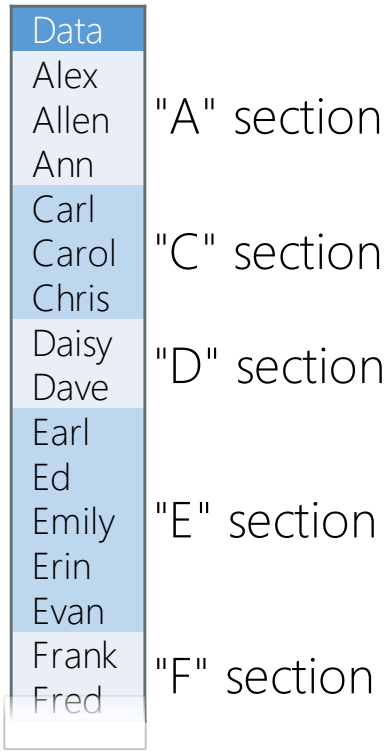
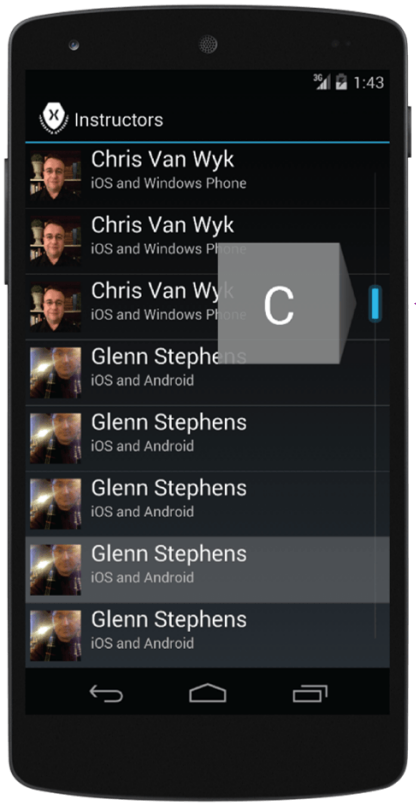
What is a Section?

- A *section* is a logical group in a list of data, you decide what the sections should be in your data



What is a Section Indexer?

- A *Section Indexer* reports section labels and indices to a **`ListView`** to help the user navigate



Section Indexer tells the **`ListView`** where the sections are and the label to display

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How to Code a Section Indexer

- Implement **`ISectionIndexer`** on your Adapter, **`ListView`** checks for this interface and uses it if available

```
public interface ISectionIndexer
{
  Java.Lang.Object[] GetSections();

  int GetPositionForSection(int section);
  int GetSectionForPosition(int position);
}
```

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How to Code GetSections

- `GetSections` returns the section labels as an array of Java objects

Data	List position	Section index	Section label
Alex	0	0	A
Allen	1	0	A
Ann	2	0	A
Carl	3	1	C
Carol	4	1	C
Chris	5	1	C
Daisy	6	2	D
Dave	7	2	D
Earl	8	3	E
Ed	9	3	E
Emily	10	3	E
Erin	11	3	E
Evan	12	3	E
Frank	13	4	F

`GetSections` should return this array

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How to Code GetPositionForSection

- Return the index of the first list position for the given section

Data	List position	Section index	Section label
Alex	0	0	A
Allen	1	0	A
Ann	2	0	A
Carl	3	1	C
Carol	4	1	C
Chris	5	1	C
Daisy	6	2	D
Dave	7	2	D
Earl	8	3	E
Ed	9	3	E
Emily	10	3	E
Erin	11	3	E
Evan	12	3	E
Frank	13	4	F

```
int GetPositionForSection(
        int section);
```

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How to Code GetSectionForPosition

- Return the index of the section containing the given list position

Data	List position	Section index	Section label
Alex	0	0	A
Allen	1	0	A
Ann	2	0	A
Carl	3	1	C
Carol	4	1	C
Chris	5	1	C
Daisy	6	2	D
Dave	7	2	D
Earl	8	3	E
Ed	9	3	E
Emily	10	3	E
Erin	11	3	E
Evan	12	3	E
Frank	13	4	F

```
int GetSectionForPosition(
        int position);
```

Group Exercise

Enable fast scrolling and code a section indexer

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Flash Quiz

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Flash Quiz

① Which `ListView` event is raised when the user clicks on a row?

a) `Click`

b) `ItemClick`

c) `ItemSelected`

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Flash Quiz

① Which **`ListView`** event is raised when the user clicks on a row?

a) `Click`

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c) `ItemSelected`

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Flash Quiz

② What is *inflation*?

a) Populating a list with rows
b) Creating a `Drawable` from an Asset file
c) Loading code-behind data into the views of a row
d) Creating a view hierarchy from a layout file

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Flash Quiz

② What is *inflation*?

a) Populating a list with rows

b) Creating a `Drawable` from an Asset file

c) Loading code-behind data into the views of a row

d) Creating a view hierarchy from a layout file

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Flash Quiz

③ If you implement the *view-holder pattern* correctly, how many times will you use `FindViewById` to locate each view in a row's view hierarchy?

a) 0

b) 1

c) 2

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Flash Quiz

③ If you implement the *view-holder pattern* correctly, how many times will you use `FindViewById` to locate each view in a row's view hierarchy?

a) 0

b) 1

c) 2

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Flash Quiz

④ To provide indexing, you implement `ISectionIndexer` on which class?

a) The `ListView` itself

b) Your custom Adapter

c) Your Main Activity

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Flash Quiz

④ To provide indexing, you implement `ISectionIndexer` on which class?

a) The `ListView` itself

b) Your custom Adapter

c) Your Main Activity

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Flash Quiz

⑤ `GetSectionForPosition` maps indices from _____

a) list position to section index
b) section index to list position
c) view position to list position

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Flash Quiz

⑤ `GetSectionForPosition` maps indices from _____

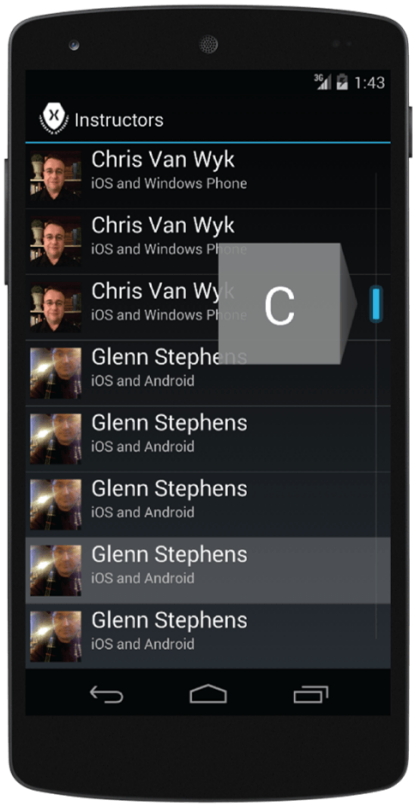
a) list position to section index

b) section index to list position

c) view position to list position

Summary

1. Enable `ListView` fast scrolling
2. Implement `ISectionIndexer` on a custom Adapter



Thank You!

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