Data Retrieval and Storage

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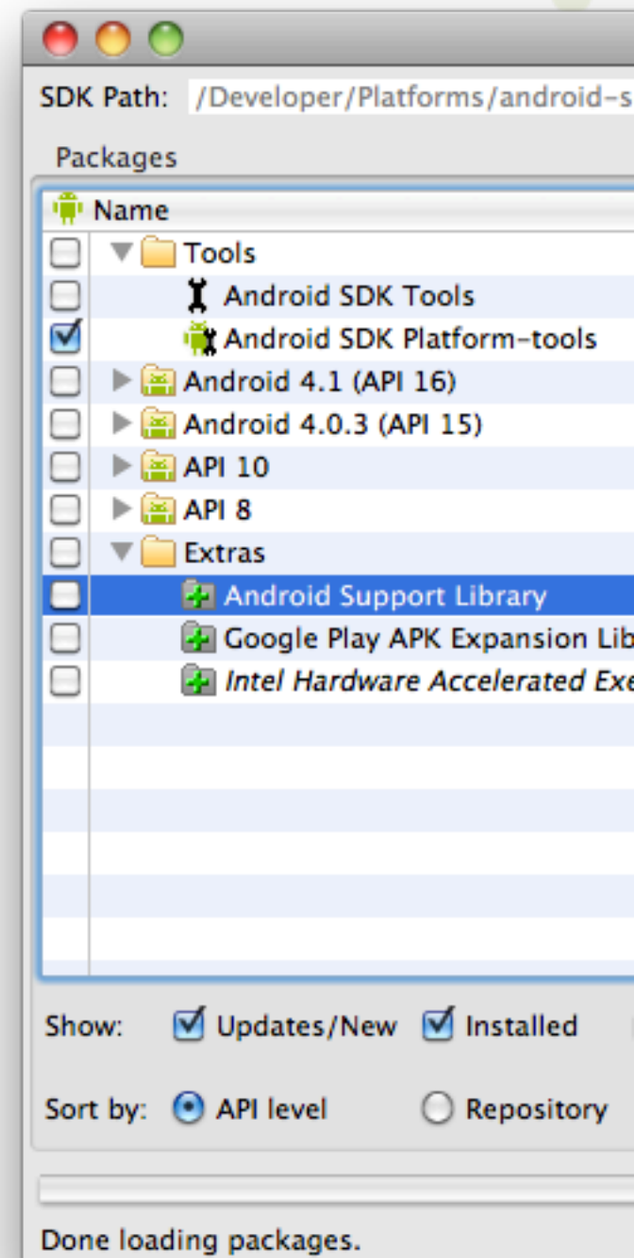
Herzliche Glückwünsche zur Mariä Himmelfahrt

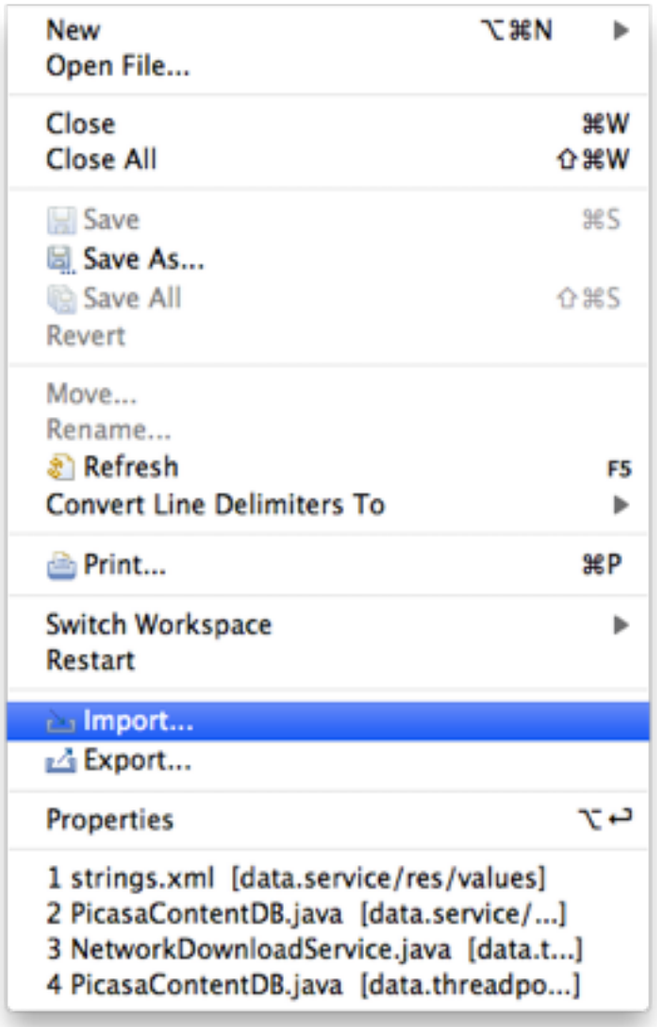
Before We Begin

- Make sure that you have
  - API level 16
  - With the support library installed
  - Java Compiler Compliance set to 1.6
- Get the Code
  - `git clone http://code.google.com/p/main-egac-2012/`



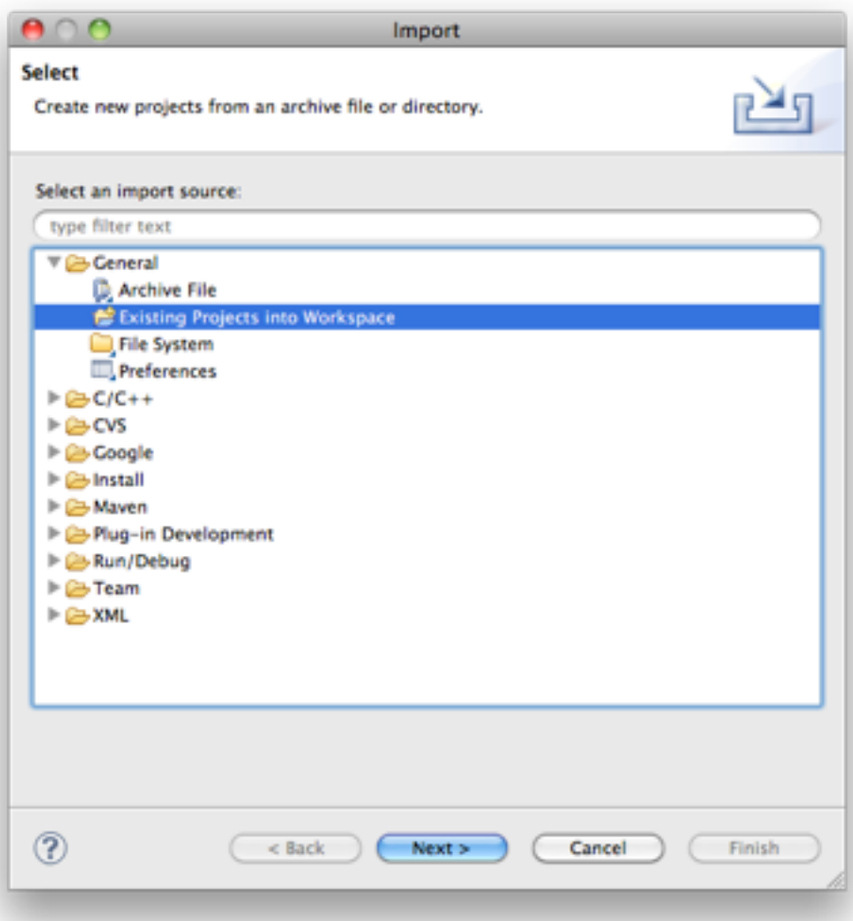
Importing Projects into Eclipse

- Select File-Import



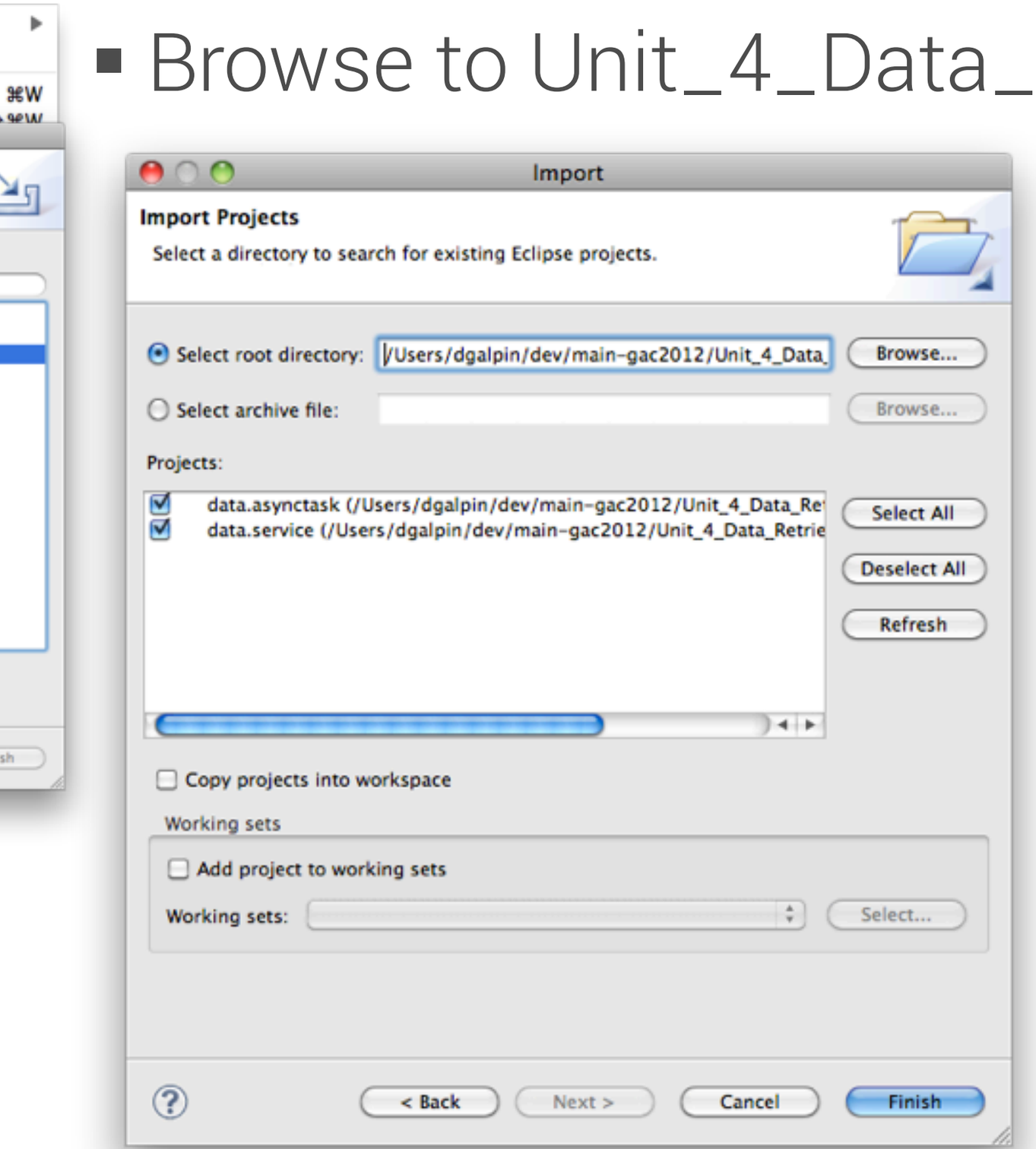
Importing Projects into Eclipse

- Select **General**
- Existing Projects into Workspace



Importing Projects into Eclipse

- Browse to Unit_4_Data_Retrieval



- Import Projects

Data Retrieval and Storage?

Retrieval

- Files
- Ports
- Users
- IPC

Storage

- Files
- Databases
- CAM
- Cloud

Universalities

- Responsive
- Thrifty
- Smart

Agenda

- Part 1: Storing and Retrieving Locally
- Part 2: Retrieving from the Internet
- Part 3: Providing Locally

Part 1: Storing and Retrieving Locally

Files

- Long stream
- No defined structure
- Best read in order
- Standard API

Shared Preferences

- Key-Value pairs
- Simple values
- Ideal for saving application state

SQL Databases

- Complex, structured, repeating data
- Random access
- Searching, filtering, reporting, combining
- Familiar API

LRU Cache

- Similar to Shared Prefrerences
- High speed, low size
- Short lived

Files

Where's my file?

- Internal storage
- Cache
- Temp
- External storage
- Media
- Shared

Sidebar: Android Security

- Unique `userid` per application
- Private by default

External Storage

- Insecure by design

File-Reading Permissions


```
<uses-permission
    android:name="android.permission.READ_EXTERNAL_STORAGE" />
<uses-permission
    android:name="android.permission.WRITE_EXTERNAL_STORAGE" />
```

Files

- Path
- Uri
- Location
- Scanner

Internal

- Permanent
- Cache

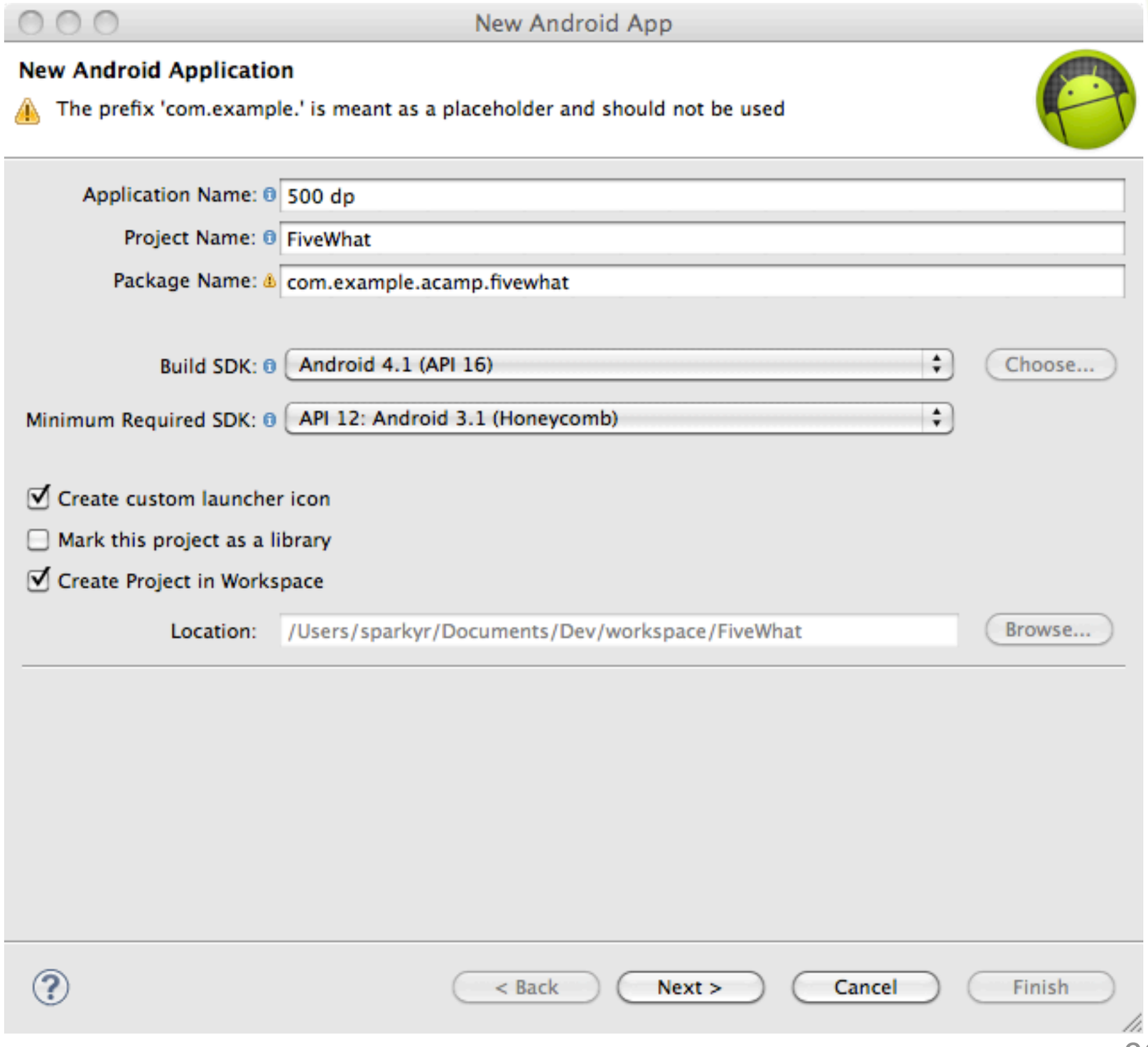
External

- “Insecure”
- “Unreliable”
- Standard locations

Code Lab 1: Read Local Assets

Step 1: Create a 2-Fragment App

- In Eclipse:
  - File > New > Android Application Project
  - MasterDetail Flow
- NOTE: Don't make any mistakes.



Step 2: Make it Dark

- In AndroidManifest.xml:

```
<uses-sdk
    android:minSdkVersion="16"
    android:targetSdkVersion="16" />
```

- In /res/values/styles.xml:
  - Delete occurrences of `.Light`

```
<style name="AppTheme" parent="android:Theme" />
                                or
<style name="AppTheme" parent="android:Theme.Holo" />
```

Step 3: Add Graphics

- Copy the drawable-* folders from Icon_Set into your project's /res/ folder. Overwrite the existing folders.
- Copy the images folder into your project's /assets/ folder.

Step 4: Read Assets Directory

- Add class ListAssetsTask into the end of DummyContent.

```
public static class ListAssetsTask extends AsyncTask<Context, Void, String[]> {

    Context mContext = null;
    String[] mAssetFiles = null;

    static final String ASSET_IMG_DIR = "images";

    @Override
    protected String[] doInBackground(Context... params) {

        mContext = params[0];

        AssetManager assetManager = mContext.getAssets();

        try {
            mAssetFiles = assetManager.list(ASSET_IMG_DIR);
        } catch (IOException e) {
            Log.e("tag", e.getMessage());
        }

        for (String filename : mAssetFiles) {
            addItem(new DummyItem(filename, ASSET_IMG_DIR + java.io.File.separator + filename));
        }
        return mAssetFiles;
    }

} // ListAssetsTask
```

Step 5: Run ListAssetsTask During Initialization

- Add Init method in DummyContent

```
public static boolean initialized = false;

public static void Init(Context context) {
    if (!initialized) {
        new ListAssetsTask().execute(context);
        initialized = true;
    }
}
```

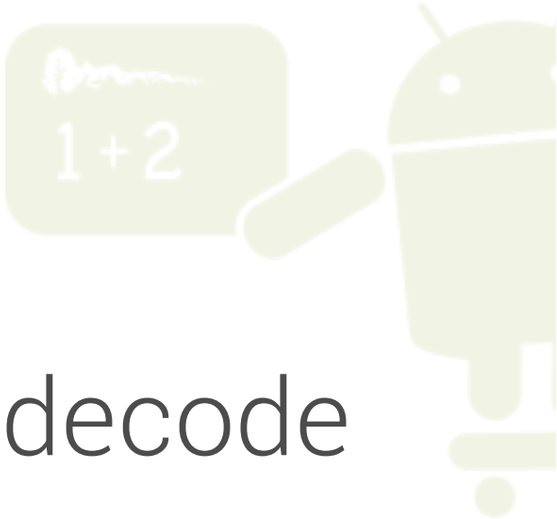
- Call Init during PicListActivity.onCreate()
- TIP: Use Cmd-Shift-O to organize imports.
- TIP: Now would be a good time to run your app and see if it reads the directory.

Step 6: Add ImageView

- Add an ImageView to fragment_pic_detail.xml
- Wrap it in a LinearLayout
  - Hint: Refactor > Android > Wrap in Container...

```xml
<LinearLayout xmlns:android="http://schemas.android.com/apk/res/android"
    xmlns:tools="http://schemas.android.com/tools"
    android:id="@+id/fragment_pic_container"
    android:layout_width="match_parent"
    android:layout_height="match_parent"
    android:orientation="vertical" >

    <TextView
        android:id="@+id/pic_detail"
        style="?android:attr/textAppearanceLarge"
        android:layout_width="wrap_content"
        android:layout_height="wrap_content"
        android:padding="16dp"
        tools:context=".PicDetailFragment" />

    <ImageView
        android:id="@+id/pic_detail_pic"
        android:layout_width="match_parent"
        android:layout_height="match_parent"
        android:contentDescription="Large image" />

</LinearLayout>
```

Step 7: Populate ImageView



- In PicDetailFragment.onCreateView(), decode image from asset file.

```
AssetManager am = getActivity().getAssets();
try {
    Drawable d = Drawable.createFromStream(am.open(mItem.content), null);
    ((ImageView) rootView.findViewById(R.id.pic_detail_pic)).setImageDrawable(d);
} catch (IOException e) {
    ((TextView) rootView.findViewById(R.id.pic_detail))
            .setText("Could not load asset: " + mItem.content);
}
```

- In DummyContent.toString(), return id.

Shared Preferences

Storage for Simple Values

- Simple types only
  - Boolean, Float, Int, Long, String, StringSet
- Persistent
- Transactional
- Implicit or Explicit groups
  - Settings are in Implicit group

Code Lab 2: Persist Application State

Step 1: Read Shared Preference

- In class DummyContent:

```
public static final String PREFS_GROUP = "DummyPrefs";
public static final String LAST_ITEM_KEY = "ItemId";
```

- In PicDetailFragment.onCreate(), check SharedPrefrerence if no id is passed.

```
if (getArguments().containsKey(ARG_ITEM_ID)) {
    mItem = DummyContent.ITEM_MAP.get(getArguments().getString(ARG_ITEM_ID));
} else {
    SharedPreferences sp =
            getActivity().getSharedPreferences(DummyContent.PREFS_GROUP,
                    Context.MODE_PRIVATE);
    String lastItemKey = sp.getString(DummyContent.LAST_ITEM_KEY, "");
    if (!TextUtils.isEmpty(lastItemKey)) {
        mItem = DummyContent.ITEM_MAP.get(lastItemKey);
    }
}
```

Step 2: Communicate via List Activity

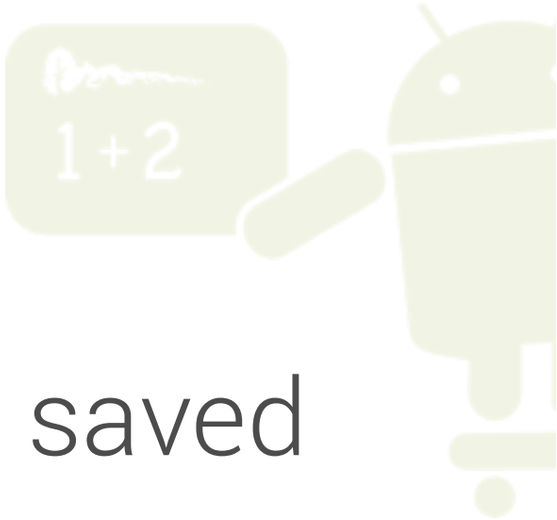
- In class PicListActivity:

```
    private String mItemSelected;
```

- In PicListActivity.onItemSelected(), record selection.

```
    public void onItemSelected(String id) {
        mItemSelected = id;
        if (mTwoPane) {
   ...
```

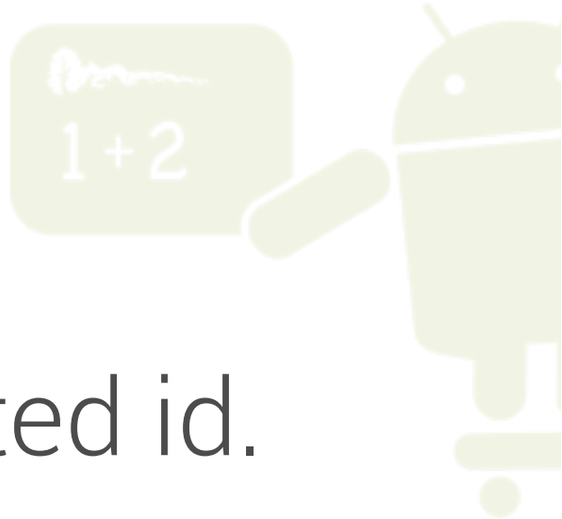
Step 3: Look for Saved Value on Create



- In PicListActivity.onCreate(), check for saved value.

```
        // If two-pane view, then if first launch, try to restore last item viewed
        if (mTwoPane && (savedInstanceState == null)) {
            SharedPreferences sp =
                    getSharedPreferences(DummyContent.PREFS_GROUP,
Context.MODE_PRIVATE);
            mItemSelected = sp.getString(DummyContent.LAST_ITEM_KEY, "");
            if (!TextUtils.isEmpty(mItemSelected)) {
                this.onItemSelected(mItemSelected);
            }
        }
```

Step 4: Save Value on Stop



- In PicListActivity.onStop(), save selected id.

```
@Override
protected void onStop() {
    if (!TextUtils.isEmpty(mItemSelected)) {
        SharedPreferences sp =
                getSharedPreferences(DummyContent.PREFS_GROUP, Context.MODE_PRIVATE);
        Editor spe = sp.edit();
        spe.putString(DummyContent.LAST_ITEM_KEY, mItemSelected);
        spe.commit();
    }
    super.onStop();
}
```

- TIP: Type “onSt” and then ctrl-space for auto-completion.

Part 2: Retrieving from the Internet

Network Data Retrieval

- Asynchronous
- Fault Tolerant
- Serial

HTTP Libraries

- http://android-developers.blogspot.co.uk/2011/09/androids-http-clients.html
- ~~Apache HTTP Client~~
- **HttpUrlConnection**

Fetching Network Data


```
@Override
protected void onHandleIntent(Intent paramIntent) {
    Process.setThreadPriority(Process.THREAD_PRIORITY_BACKGROUND);
    String str = paramIntent.getDataString();
    URL url;
    try {
        url = new URL(str);
        URLConnection urlConn = url.openConnection();
        if ((urlConn instanceof HttpURLConnection)) {
            HttpURLConnection hUrlConn = (HttpURLConnection) urlConn;
            hUrlConn.setRequestProperty("User-Agent", USER_AGENT);
            hUrlConn.getResponseCode();
...
```

Wire Formats

- Human-readable
- Be lazy: Use a standard
- XML, JSON, SOAP

SAX vs. XML Pull Parser

- ~~SAX~~
- **XmlPullParser**

Storing the Data - PullParser


```
    mImage = new ContentValues();
} else {
    String key;
    if (str1.equalsIgnoreCase(CONTENT)) {
        key = PicasaContentDB.PicasaFeatured.IMAGE_URL;
    } else if (str1.equalsIgnoreCase(THUMBNAIL)) {
        key = PicasaContentDB.PicasaFeatured.IMAGE_THUMB_URL;
    } else continue;
    String value = localXmlPullParser.getAttributeValue(null, "url");
    if (value == null) break;
    mImage.put(key, value);
}
```

Parsing XML with XmlPullParser

```
XmlPullParser localXmlPullParser = localXmlPullParserFactory.newPullParser();
localXmlPullParser.setInput(paramInputStream, null);
int i = localXmlPullParser.getEventType(), j = 1;
if (i != 0) return;
this.mImages = new Vector<ContentValues>(NUM_IMAGES);
while (true) {
    int k = localXmlPullParser.next();
    if (Thread.currentThread().isInterrupted()) throw new XmlPullParserException("Cancelled");
    else if (k == XmlPullParser.END_DOCUMENT) break;
    else if (k == XmlPullParser.START_DOCUMENT) continue;
    else if (k == XmlPullParser.START_TAG) {
        String str1 = localXmlPullParser.getName();
        if (str1.equalsIgnoreCase(ITEM)) { mImage = new ContentValues();
        } else {
            String key;
            if (str1.equalsIgnoreCase(CONTENT)) key = PicasaContentDB.PicasaFeatured.IMAGE_URL;
            else if (str1.equalsIgnoreCase(THUMBNAIL)) key =
PicasaContentDB.PicasaFeatured.IMAGE_THUMB_URL;
            else continue;
            String value = localXmlPullParser.getAttributeValue(null, "url");
            if (value == null) break;
            mImage.put(key, value);
        }
    }
    else if ((k == XmlPullParser.END_TAG) && (localXmlPullParser.getName().equalsIgnoreCase(ITEM))
            && (mImage != null)) {
        this.mImages.add(mImage); mImage = null; j++;
    }
}
```

Avoid This!


Sorry!
Activity Slow Pro (in
application Sl rocess) is
not respond
Wait

Use a Thread

AsyncTask<Params, Progress, Result>


```
private class MyTask extends AsyncTask<Foo, Integer, Bar> {
    @Override
    protected Bar doInBackground(Foo... params) {
        publishProgress(42);
        return null;
    }

    @Override
    protected void onPostExecute(Bar result) {
        super.onPostExecute(result);
    }

    @Override
    protected void onProgressUpdate(Integer... values) {
        super.onProgressUpdate(values);
    }
}
MyTask myTask = new MyTask();
Bar result = myTask.execute(foo).get();
```

Use a Service with a Thread

Android Services

- Have a background lifecycle
- Are a registered component
- Have a Context
- Run in the UI Thread

Declaring a Service in the Manifest


```
<service
    android:exported="false"
    android:name="sample.multithreading.NetworkDownloadService" />
```

Deriving from IntentService


```
public class NetworkDownloadService extends IntentService {

    public NetworkDownloadService() {
        super("PicasaFeaturedService");
    }

    @Override
    protected void onHandleIntent(Intent paramIntent) {
    }
}
```

Starting the IntentService


```
private static final String PICASA_RSS_URL = "http://
picasaweb.google.com/data/feed/base/featured?
alt=rss&kind=photo&access=public&slabel=featured&hl=en_US&imgmax=1600"

Intent localIntent = new Intent(this, NetworkDownloadService.class);
Uri localUri = Uri.parse(PICASA_RSS_URL);
localIntent.setData(localUri);

startService(localIntent);
```

Communicating Status From the Service

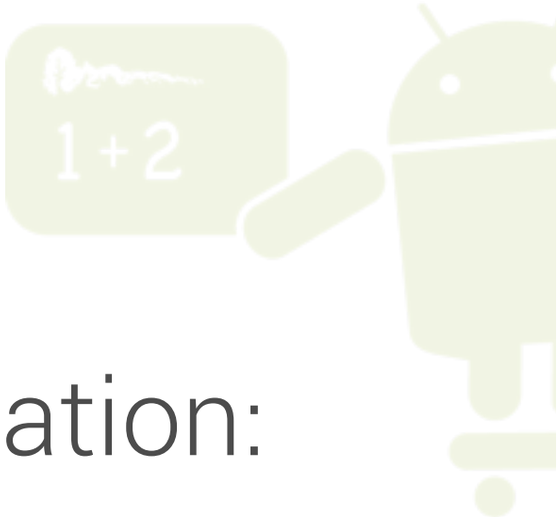
```
private class ResponseReceiver extends BroadcastReceiver
{
    private ResponseReceiver() {}

    @Override
    public void onReceive(Context paramContext, Intent paramIntent) {
        switch (paramIntent.getIntExtra
(NetworkDownloadService.EXTRA_STATUS,
                NetworkDownloadService.STATE_ACTION_COMPLETE)) {
            case NetworkDownloadService.STATE_ACTION_STARTED:
                setProgressText(R.string.progress_starting_update);
                showProgress(true);
                break;
...
```

AsyncTask or IntentService

- AsyncTask integrates more
- Service can do more different things

Code Lab 3: Retrieve Data from the Web

Step 1: Declare INTERNET Permission



- In AndroidManifest.xml, above <application:

```
<!--
Only a n00b forgets to declare internet permission on a feed reader.
-->
<uses-permission android:name="android.permission.INTERNET" />
```

Step 2: Copy new Java source code files

- NetworkDownloadService.java
- PicasaPullParser.java

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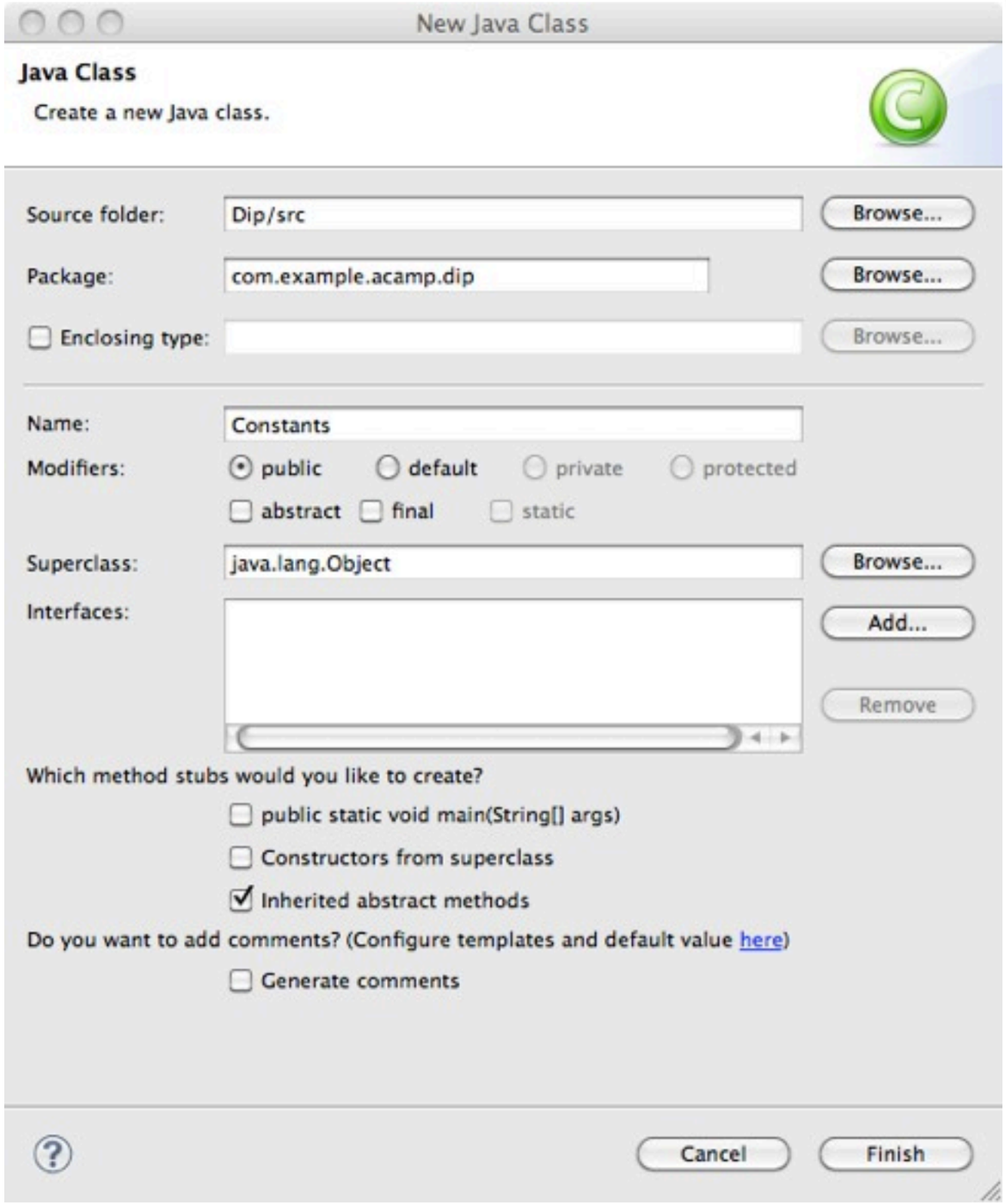
Step 3: Create Constants Class

- Right-click on package
  - com.example.acamp.dip
- New > Class ...



Step 4: Populate Constants

```
public class Constants {
    static public final boolean LOGV = true;
    public static final String IMAGE_THUMB_URL = "thumbURL";
    public static final String IMAGE_URL = "imageURL";
    public static final int NUM_LINES = 100;
    public static final String PICASA_RSS_URL = "http://picasaweb...";
}
```

- Add public DummyContent.addItem()

```
    public static void addItem(String key, String content) {
        addItem(new DummyItem(key, content));
    }
```

- http://picasaweb.google.com/data/feed/base/featured?alt=rss&kind=photo&access=public&slabel=featured&hl=en_US&imgmax=1024&max-results=10

Step 5: Declare Download Service

- In AndroidManifest.xml, before </application>:

```
<!--
Fetches network content in a background task and provides it to the content Views.
-->
<service
     android:name=".NetworkDownloadService"
    android:exported="false" />
</application>
```

Step 6: Image Download Task

- Implement PicDetailFragment.GetImageTask class

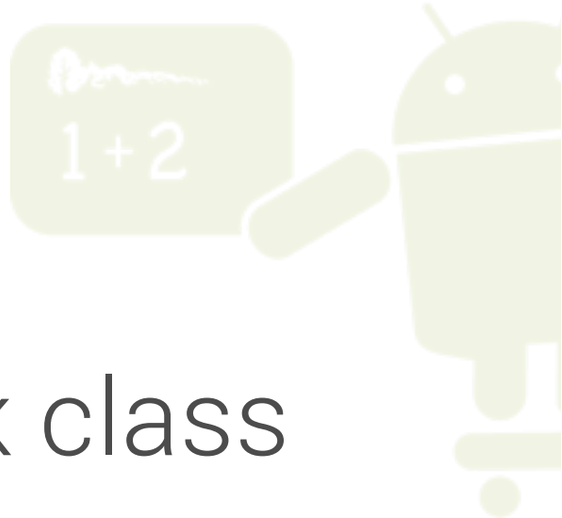
```
public final class GetImageTask extends AsyncTask<String, Void, Bitmap> {

    @Override
    protected Bitmap doInBackground(String... params) {
        String picUrlStr = params[0];
        URL picUrl;
        InputStream is;
        Bitmap b = null;

        if (TextUtils.isEmpty(picUrlStr)) {
            return null;
        }

        try {
            picUrl = new URL(picUrlStr);
            is = (InputStream) picUrl.getContent();
            b = BitmapFactory.decodeStream(is);
        } catch (MalformedURLException e) {
            // TODO Auto-generated catch block
            e.printStackTrace();
        } catch (IOException e) {
            // TODO Auto-generated catch block
            e.printStackTrace();
        }
        return b;
    }
}
```

Step 7: Use Image Download Task



- Use PicDetailFragment.GetImageTask class

```
public View onCreateView(LayoutInflater inflater, ViewGroup container, Bundle savedInstanceState) {
    View rootView = inflater.inflate(R.layout.fragment_pic_detail, container, false);
    mImageView = (ImageView) rootView.findViewById(R.id.pic_detail_pic);

    if (mItem != null) {

        if (mImageView != null) {

            Bitmap b = null;
            GetImageTask git = new GetImageTask();

            // The documentation implies that ImageView.setImageBitmap
            // does not run on the UI thread, so we don't need to do this in
            // an AsyncTask.
            try {
                b = git.execute(mItem.content).get();
                mImageView.setImageBitmap(b);
...
```

Step 7: Broadcast Receiver

- Instantiate a BroadcastReceiver in PicListFragment.onCreate()

```
        // Set up the broadcast mReceiver so that the ArrayAdapter can update.
        IntentFilter filter = new IntentFilter();
        filter.addAction(DummyContent.ACTION_UPDATE);

        mReceiver = new BroadcastReceiver() {
            @Override
            public void onReceive(Context context, Intent intent) {
                @SuppressWarnings("unchecked")
                ArrayAdapter<DummyContent.DummyItem> aa = (ArrayAdapter<DummyItem>) getListAdapter();
                aa.notifyDataSetChanged();
            }
        };
        getActivity().registerReceiver(mReceiver, filter);
```

- Unregister it in onDestroy()

```
    public void onDestroy() {
        getActivity().unregisterReceiver(mReceiver);
        super.onDestroy();
    }
```

Step 8a: Broadcast Content Updates

- Broadcast updates from NetworkDownloadService

```
Intent intent = new Intent();
intent.setAction(DummyContent.ACTION_UPDATE);
sendBroadcast(intent);
```

- Invoke NetworkDownloadService from DummyContent

```
public static void Init(Context context) {
    if (!initialized) {
        Intent initIntent = new Intent(context, NetworkDownloadService.class);
        Uri localUri = Uri.parse(Constants.PICASA_RSS_URL);
        initIntent.setData(localUri);
        context.startService(initIntent);
        initialized = true;
    }
}
```

Step 8b: Broadcast Content Updates

- Define Intent action in DummyContent

```
public static final String ACTION_UPDATE = "com.example.acamp.fivewhat.dummy.update";
```

Part 3: Providing Locally

What is a Content Provider?

- Interface
- For sharing content
- Often backed by SQL

SQLite Database

SQLiteOpenHelper


```
@Override
public void onCreate(SQLiteDatabase paramSQLiteDatabase) {
}

@Override
public void onUpgrade(SQLiteDatabase paramSQLiteDatabase,
        int paramInt1, int paramInt2) {
}
```

Why do I need SQL Open Helper?

- Helps manage lifecycle of SQL Database
- Off UI thread

Declaring a Content Provider

In AndroidManifest.xml:

```
<provider
    android:name="sample.multithreading.PicasaContentDB"
    android:exported="false"
    android:authorities="@string/picasa_authority"
    />
```

In values/strings.xml:

```
<resources>
    <string name="picasa_authority"
translatable="false">sample.multithreading.PicasaDB</string>
    <string name="picasa_faves_table" translatable="false">faves</
string>
```

Why do I need a Content Provider?

- Share across apps
- Standard interface
- Contract

Code Lab 3 Extra Credit Ideas

- Scheduled fetching
- Incremental fetching
- Caching
- Push notification

Let’s discuss!

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