

EMBEDDED SYSTEMS PROGRAMMING 2014-15

Android Content Providers

APP COMPONENTS

- **Activity:** a single screen with a user interface
- **Broadcast receiver:** responds to system-wide broadcast events. No user interface
- **Service:** performs (in the background) long-running operations (e.g., music playback). No user interface
- ➔ ● **Content provider**

CONTENT PROVIDER

- Encapsulates structured data that need to be shared across applications
- The official way to share data across applications
- Encapsulates data = provides a common interface for adding, modifying, querying, deleting,... data
- Does not provide a way to store data. “How a content provider actually stores its data under the covers is up to its designer”

DATA MODEL

- Data are exposed as **tables** (like in a database)
- Multiple tables can be handled by a single content provider
- Every table includes an **_ID column**, which holds a unique numeric ID for each record

CLASSES (1/2)

`android.content` package:

- **ContentProvider** abstract class
Encapsulates data
- **ContentResolver** abstract class
Provides access to data stored in a `ContentProvider`

`android.net` package:

- **Uri** class
Provides a mean of identifying tables and rows

URI

- **Uniform Resource Identifier**
- Described by [RFC 2396](#)
- **Syntax:**
 - **Scheme name** (`content` for content providers)
 - “`://`”
 - **Authority** (in this case, the name of the content provider)
 - **Path to resource.** Path components are separated by “`/`”

URI IN CONTENT PROVIDERS: EXAMPLES

- All URIs for providers begin with `content://`
- URI of a content provider:

```
content://it.unipd.dei.esp1112.AddressBookProvider
```

- URI of a table (the table named `People`):

```
content://it.unipd.dei.esp1112.AddressBookProvider/People/
```

- URI of a single row (the row with `_ID=24`):

```
content://it.unipd.dei.esp1112.AddressBookProvider/People/24
```

CLASSES (2/2)

- Content providers must be declared in `AndroidManifest.xml`
- The system, not the user, instantiates content providers (i.e., objects from subclasses of `ContentProvider`)
- One instance for each class, hence one instance for each type of content provider
- The instance can deal with multiple requests by communicating with multiple content resolvers

EXAMPLES (1/2)

- Declaring a custom content provider

```
<?xml version="1.0" encoding="utf-8"?>

<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="it.unipd.dei.esp1112.cp1"
    android:versionCode="1"
    android:versionName="1.0.0">

    <application android:icon="@drawable/icon" android:label="@string/app_name">

        <provider android:name="MyAddressBook"
            android:authorities="it.unipd.dei.esp1112.AddressBookProvider"
            android:exported="true">
            <grant-uri-permission android:pathPattern=".*" />
        </provider>
        ...
    </application>

</manifest>
```

EXAMPLES (2/2)

- Asking for the permission to read data from Android's Contacts content provider

```
<?xml version="1.0" encoding="utf-8"?>
<manifest xmlns:android="http://schemas.android.com/apk/res/android"
    package="it.unipd.dei.esp1112.cp2"
    android:versionCode="1"
    android:versionName="1.0.0">

    <uses-permission android:name="android.permission.READ_CONTACTS" />

    <application android:icon="@drawable/icon" android:label="@string/app_name">
    ...
    </application>
</manifest>
```

CONTENTPROVIDER CLASS: METHODS (1/3)

- **boolean onCreate()**
Initializes the content provider.
Advice: lengthy initializations, such as opening an `SQLiteDatabase`, should be deferred until the content provider is actually used
- **String getType(Uri uri)**
Returns the MIME type of data in the content provider at the given URI

CONTENTPROVIDER CLASS: METHODS (2/3)

- **Uri insert(Uri uri, ContentValues values)**
Inserts a new row in the table at the URI `uri`.
Returns the URI for the newly inserted item
- **int update(Uri uri, ContentValues values, String selection, String[] selectionArgs)**
Updates all rows matching the `selection` filter in the table (or record) identified by `uri`. New values are contained in `values`, which is a mapping from column names to new column values.
Returns the number of affected rows
- **int delete(Uri uri, String selection, String[] selectionArgs)**
Deletes all rows matching the `selection` filter in the table (or record) identified by `uri`.
Returns the number of affected rows

CONTENTPROVIDER CLASS: METHODS (3/3)

- `Cursor query(Uri uri, String[] projection, String selection, String[] selectionArgs, String sortOrder)`

Performs a query among all rows matching the `selection` filter in the table (or record) identified by `uri`.

`projection` contains a list of columns to put into the result.

The result of the query is returned as a `Cursor` object

CONTENTRESOLVER CLASS: METHODS

- All data modifications and queries are performed indirectly via `ContentResolver` methods
- `ContentResolvers` are not instantiated, but obtained by invoking `getContentResolver()` from within an activity or other application component
- Same methods of a `ContentProvider`: `insert()`, `update()`, `delete()`, `query()`, ...

EXAMPLES (1/2)

- Obtaining a single record from Android's addressbook

```
import android.provider.Contacts.People;
import android.net.Uri;
import android.database.Cursor;
import android.content.ContentResolver;

...

// Use the Uri class to build the URI
Uri myPerson = Uri.withAppendedPath(People.CONTENT_URI, "23");

// Obtain a content resolver
ContentResolver cr = getContentResolver();

// Query for the specific record
Cursor cur = cr.query(myPerson, null, null, null, null);

...
```

EXAMPLES (2/2)

- Obtaining a set of records from Android's addressbook

```
import android.provider.Contacts.People;
import android.net.Uri;
import android.database.Cursor;
import android.content.ContentResolver;

...

// Form an array specifying which columns to return.
// The names of the columns are available as constants in the People class
String[] projection = new String[] {People._ID, People._COUNT,
                                     People.NAME, People.NUMBER};

// Get the base URI for the People table in the Contacts content provider
Uri contacts = People.CONTENT_URI;

// Make the query
Cursor Cur = getContentResolver().query
    (contacts,
     projection, // Which columns to return
     null,       // Which rows to return (all rows)
     null,       // Selection arguments (none)
     People.NAME + " ASC"); // Put results in ascending order by name

...
```


REFERENCES

- Content Providers
- “Working with Content Providers” tutorial on Tuts+
- RFC 2396

LAST MODIFIED: MAY 13, 2015

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