A Case Study of Mobile Application Development

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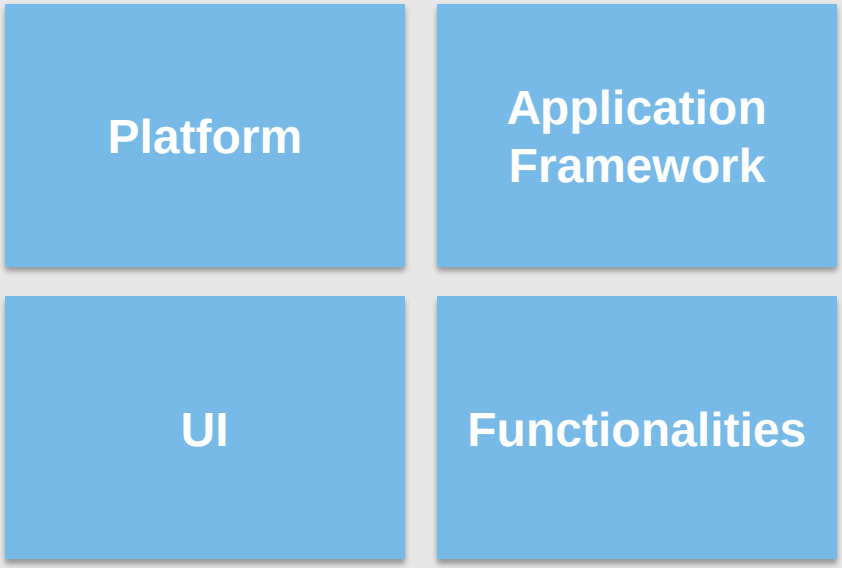
Content

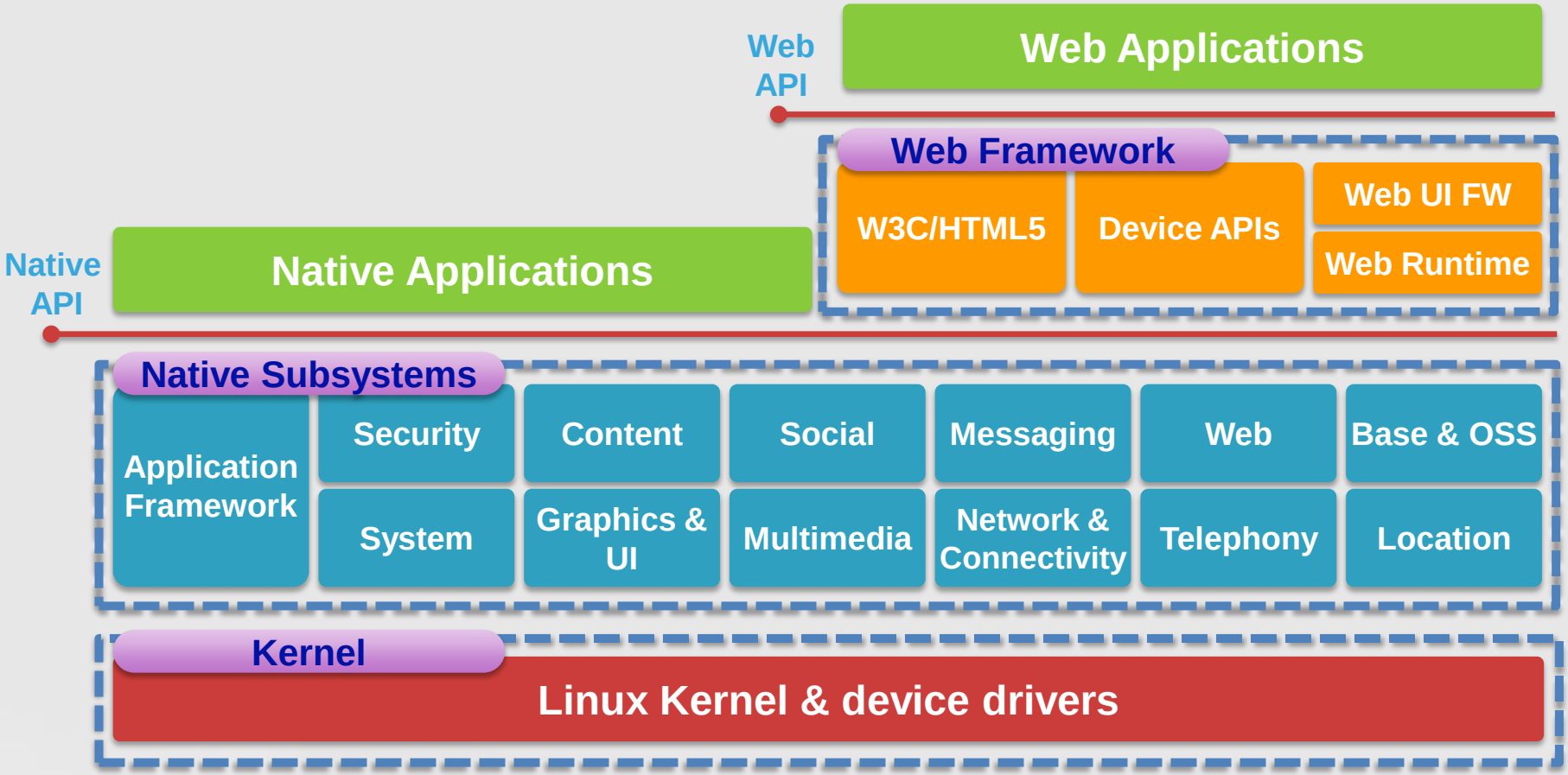
- **Tizen Application Development**
- **Practices of Tizen Application Development**
  - Performance optimization
  - Memory usage
  - Database usage

Tizen Application Development

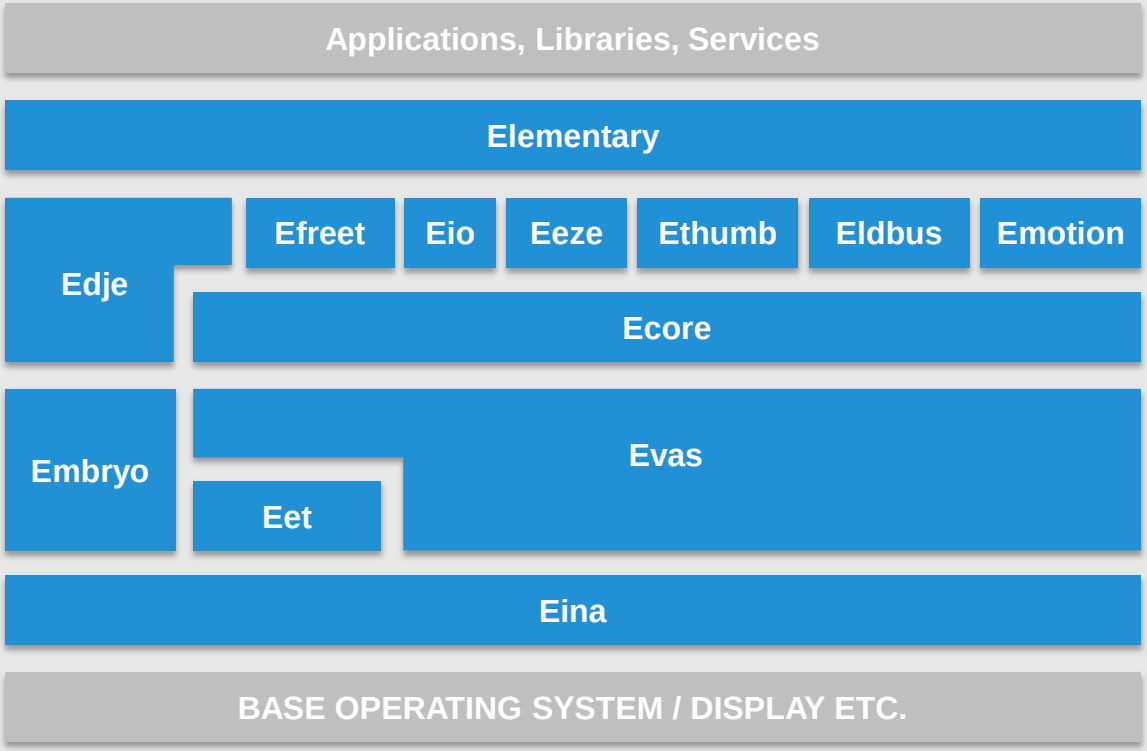
Application Development - Start from Here

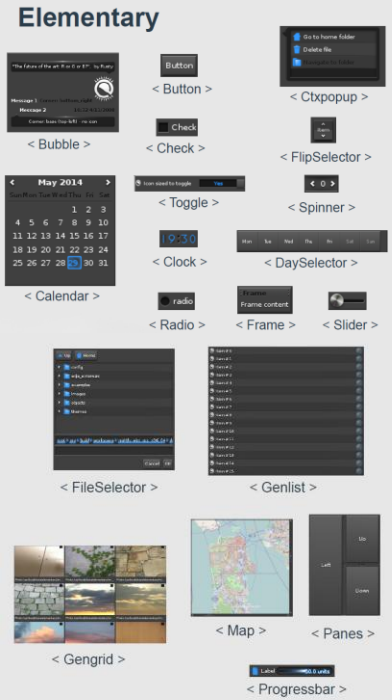


Tizen Architecture

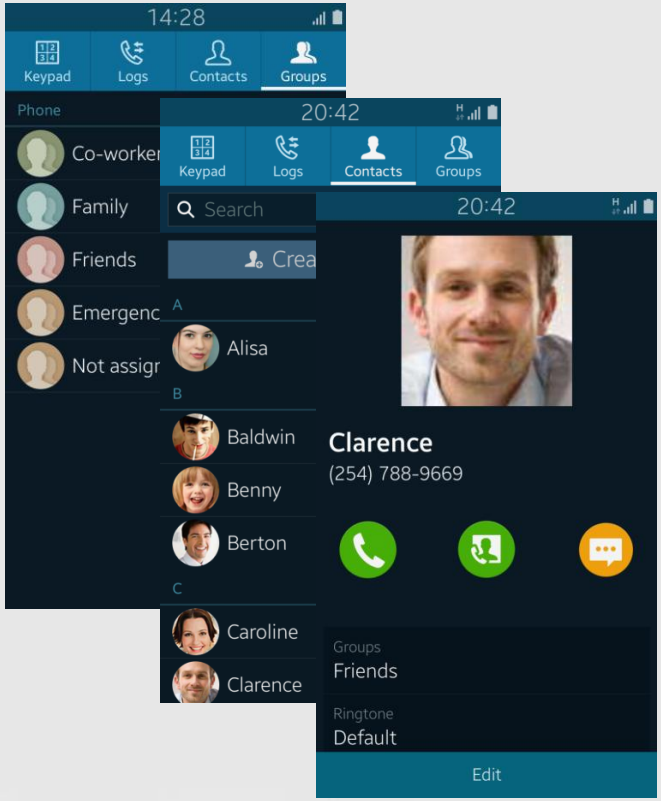


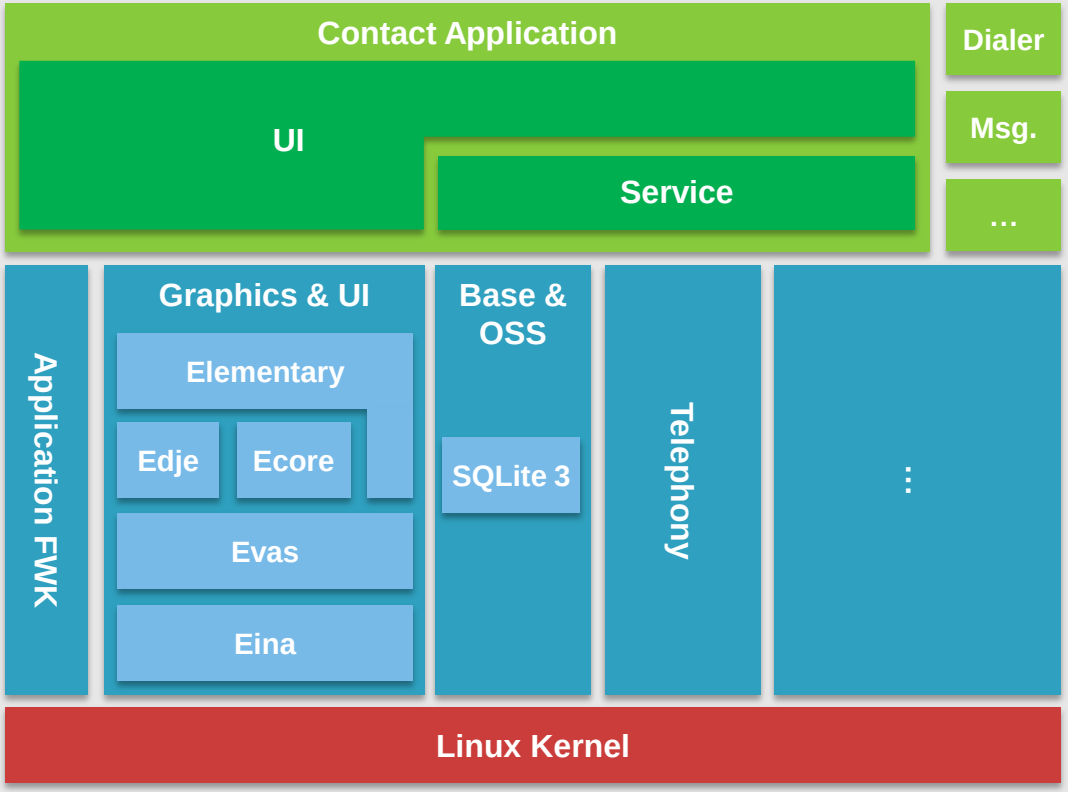
EFL Architecture



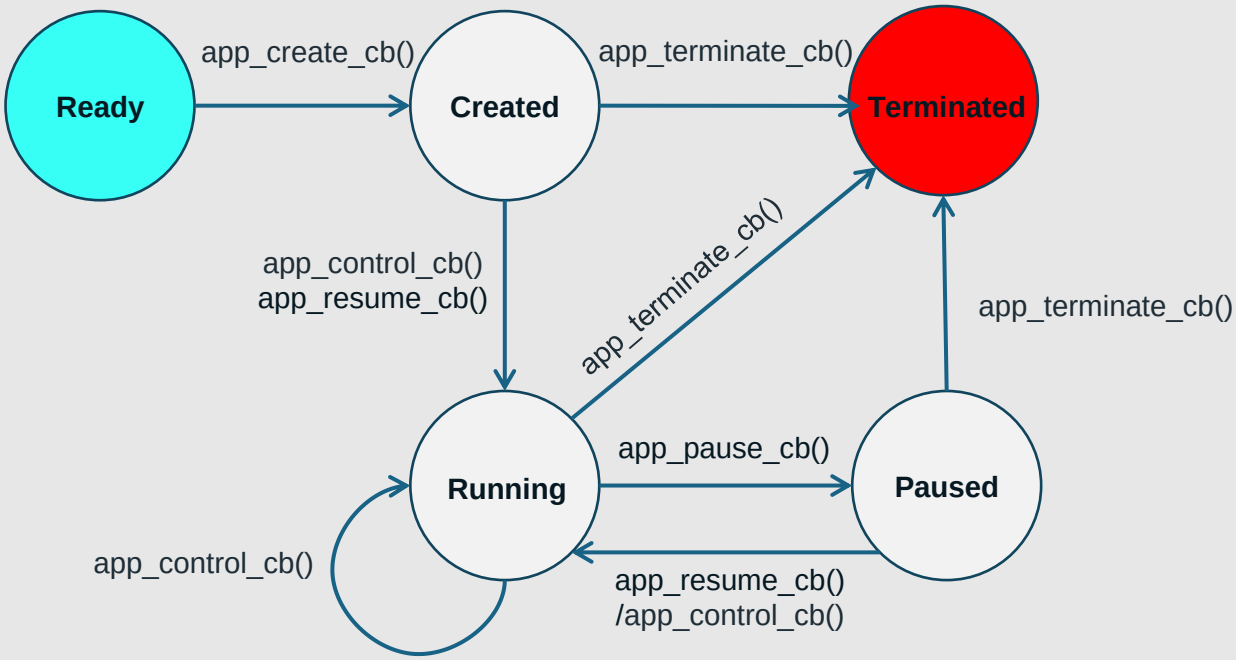


Case Study: Contact Application





Application Lifecycle

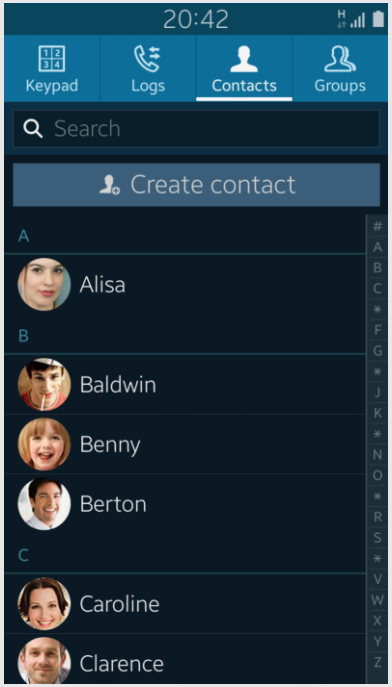


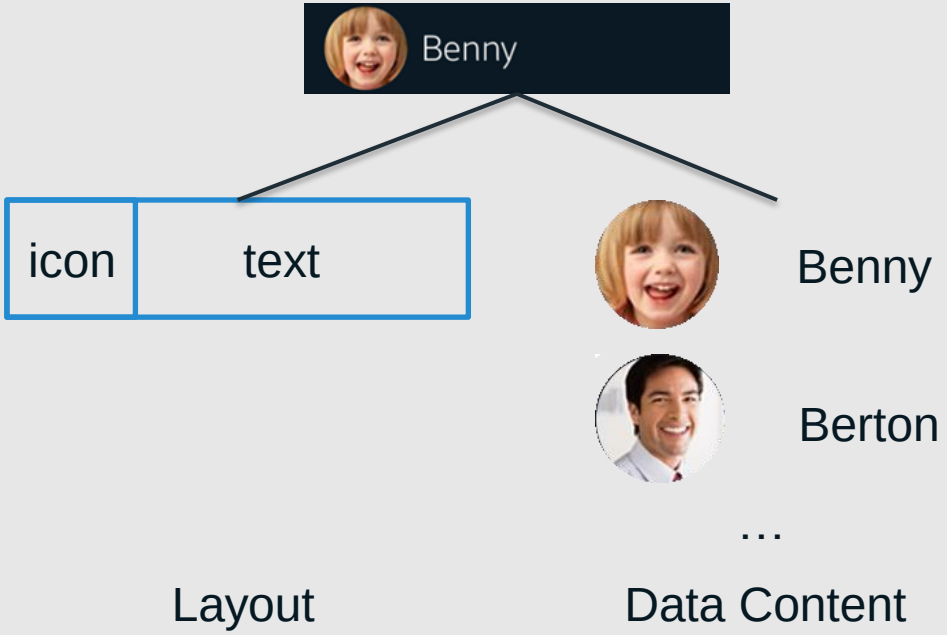
Sample Code of main()

```
int  main(int argc, char *argv[])
{
    struct appdata ad;
    app_event_callback_s event_callbacks;
    event_callbacks.create = ct_create;
    event_callbacks.terminate = ct_terminate;
    event_callbacks.pause = ct_pause;
    event_callbacks.resume = ct_resume;
    event_callbacks.app_control = ct_app_control;
    …
    return app_efl_main(&argc, &argv, &event_callbacks, &ad);
}
```

UI Analysis

- Layout
- Widget selection





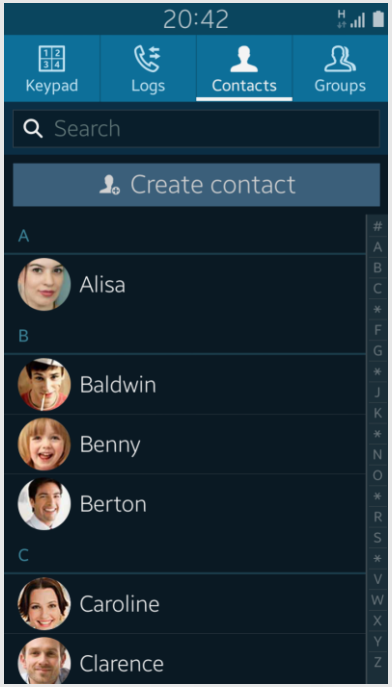
Edje

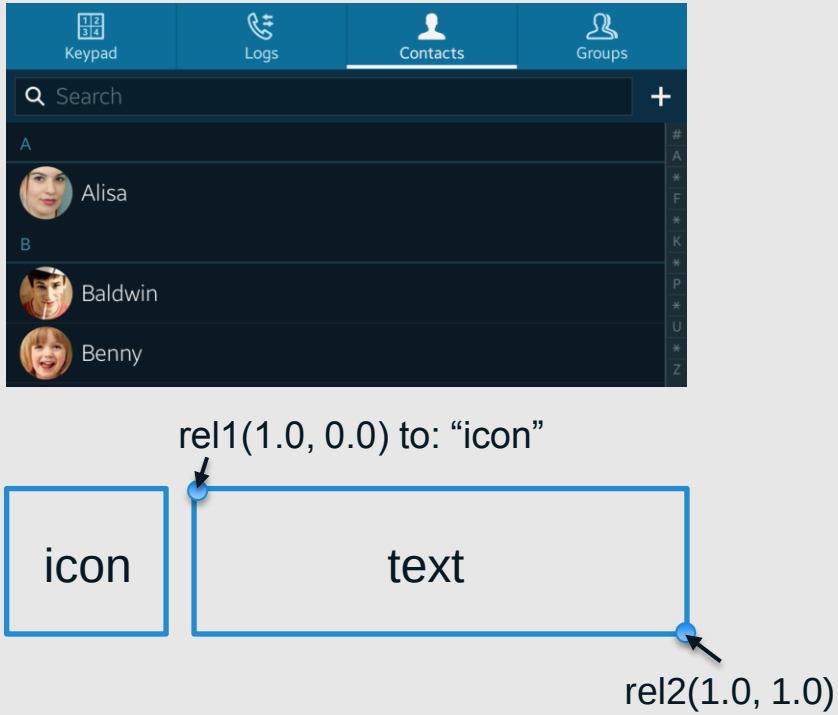
- A complex graphical design and layout library
- Create visual layouts from compiled EDC script
- Support relative and absolute positioning

```
collections { - list the groups.
   group { - the list of parts and programs that compose a given edje object.
      images { } – list each image file that will be used in the edc.
      parts {
         part { - the most basic design elements of the group.
                  (i.e. RECT, TEXT, IMAGE, SWALLOW, TEXTBLOCK, GROUP, BOX, TABLE, EXTERNAL)
         }
      }
      programs {
          program { - manipulates the different interface elements and serve as a bridge between
                      the application and interface.
          }
      }
   }
}
```

Scalability

- **Relative position**





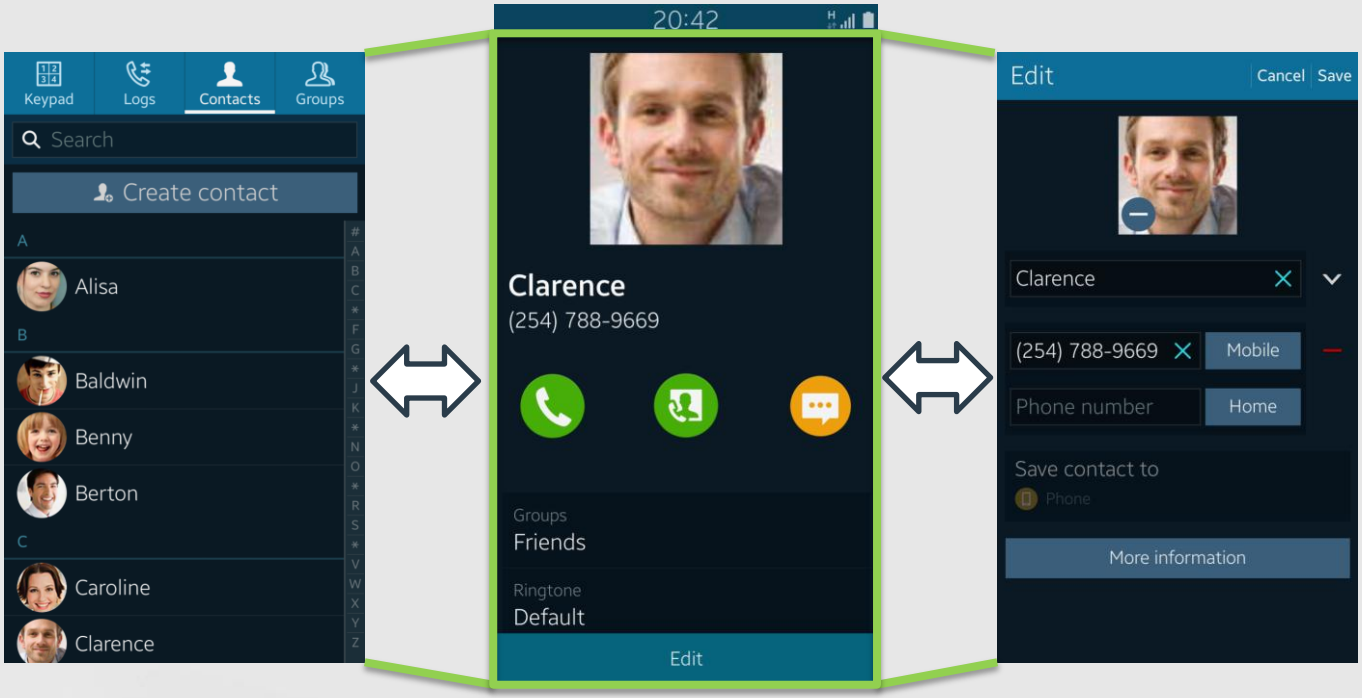
Sample Code of UI Layout

```
group {
    name: "item";
    parts {
        part {
            name: “icon";
            type: SWALLOW;
            description {
                state: "default" 0.0;
                min: 72 0;
                align: 0.0 0.5;
                fixed: 1 0;
                rel1 { relative: 0.0 0.0 ;}
                rel2 { relative: 0.0 1.0 ;}
            }
        }
```

```
        part {
            name: “text";
            type: TEXT;
            description {
                state: "default" 0.0;
                rel1 { relative: 1.0 0.0 ; to: “icon";}
                rel2 { relative: 1.0 1.0 ; }
            }
        }
        …
    }
    …
```

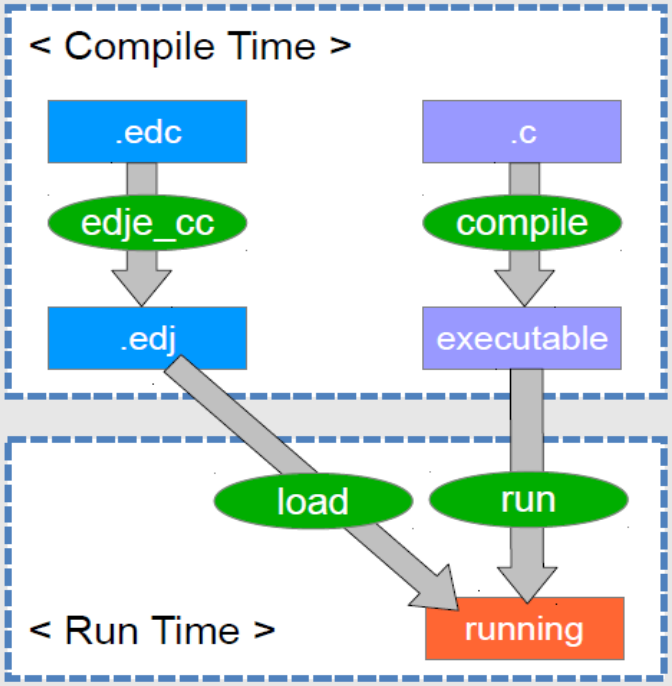
Application View

- View control with naviframe



Building Application

- **Separation of layout and logic**
  - A graphical part: GUI layout binary (edj)
  - A functionality: executable logic binary (C)

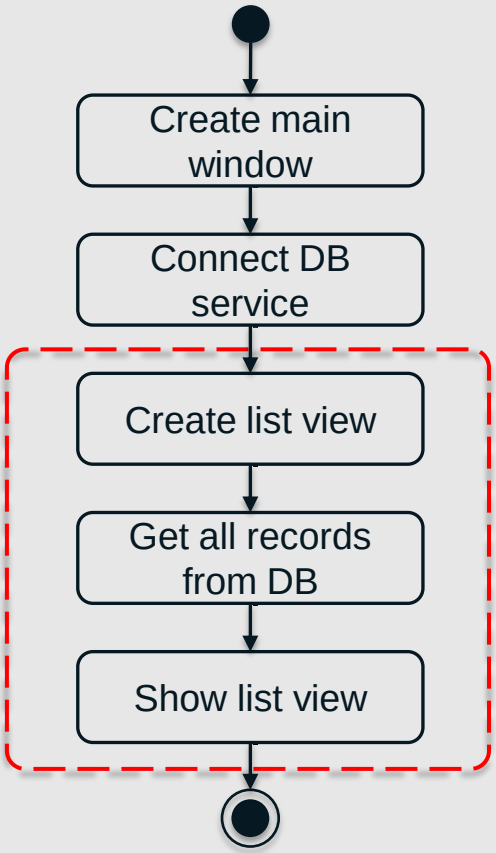


Practices of Performance Optimization

Launching Performance Analysis

- **Synchronized procedure**
  - Poor performance for mass data

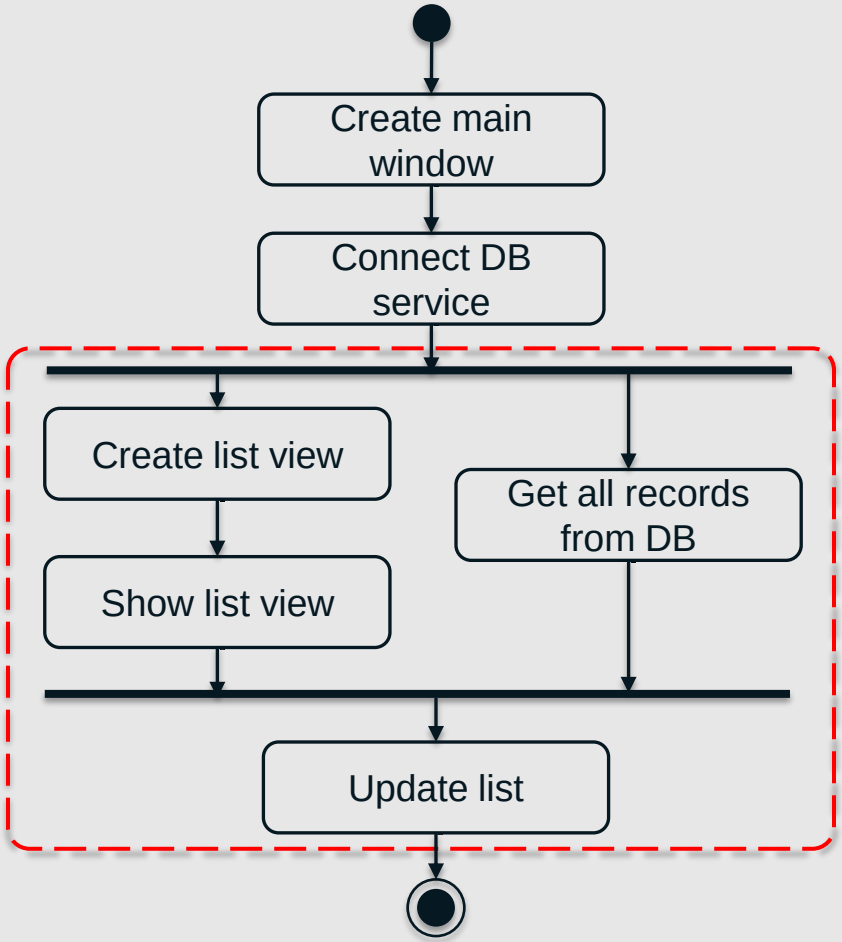
App	Condition	Launching Time
Contact	10000 records	**2.27s**



Processing in Parallel

- **Multi-threads processing**
  - Retrieving data asynchronously

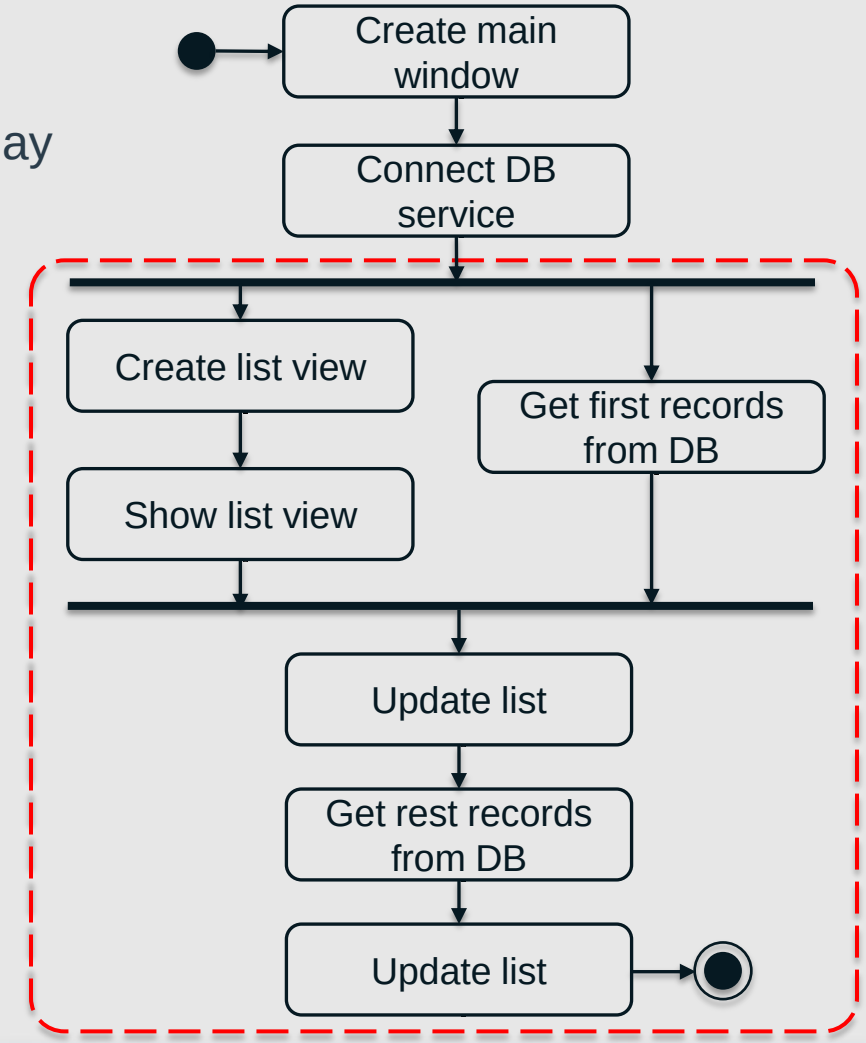
App	Condition	Launching Time
Contact	10000 records	**1.53s**



Further Optimization

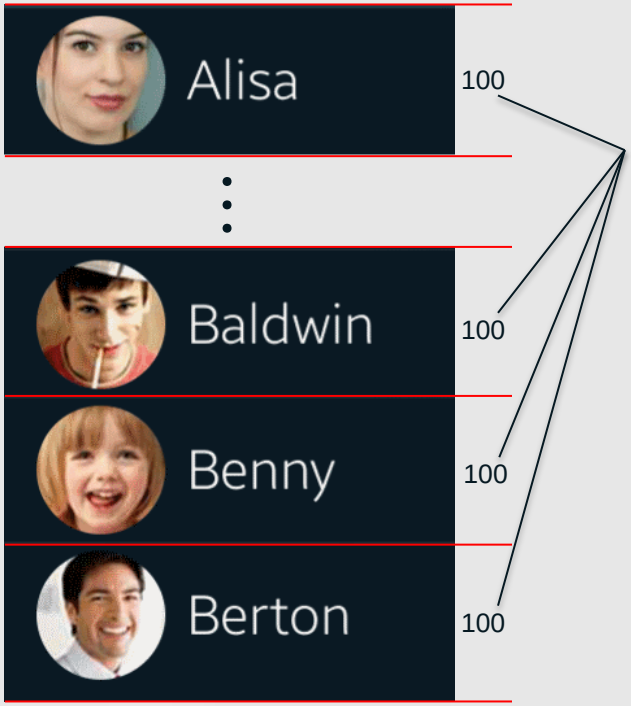
- **Splitting data loading**
  - Retrieving necessary data for display
  - Loading rest data in idle state

App	Condition	Launching Time
Contact	10000 records	**1.04s**



List Items Loading

- **Create list item with elm_genlist_homogeneous_set()**



The height of list items should be same

```
…
Evas_Object *ct_create_genlist(…)
{
    …
    genlist = elm_genlist_add (parent);
    elm_genlist_homogeneous_set(genlist, EINA_TRUE);
    …
    elm_genlist_item_append(…);
    …
}
```

Practices of Memory Usage

Memory Tool in Tizen

- **Valgrind**
  - For memory debugging, memory leak detection, and profiling

Null pointer dereference

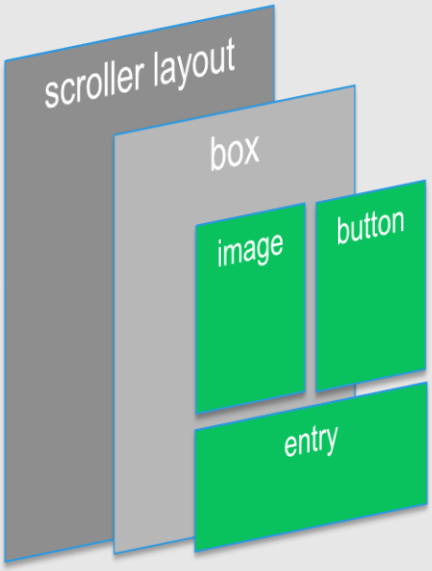
```
==2741== Invalid write of size 4
==2741==    at 0x57700B0: ct_input_push_navi_content (ct-input-view.c:7694)
==2741==    by 0x5752A29: ct_input_launch_preloaded_view (ct-detail-main.c:833)
==2741==    by 0x4953579: ct_list_create_contact_btn_clicked_cb (ct-list-contact-view.c:539)
==2741==    by 0x4D2E83F: evas_object_smart_callback_call (in /usr/lib/libevas.so.1.7.99)
==2741==  Address 0x0 is not stack'd, malloc'd or (recently) free'd
```

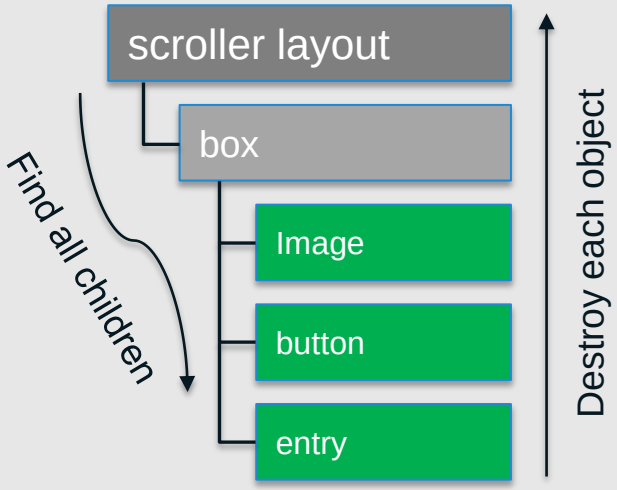
Memory leak

```
==11097== 1,024 bytes in 1 blocks are definitely lost in loss record 144 of 196
==11097==    at 0x4834FBC: malloc (vg_replace_malloc.c:291)
```

Widget Object Release

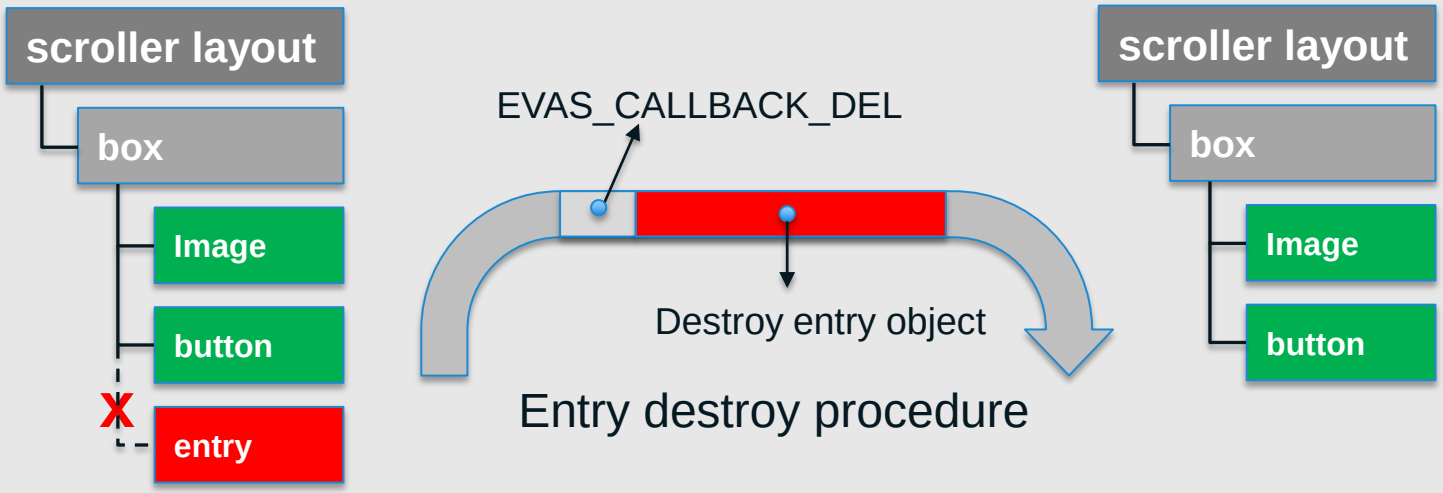
- **Lifecycle of widget object**





User Data Release

- **Event in object destroy**
  - EVAS_CALLBACK_DEL

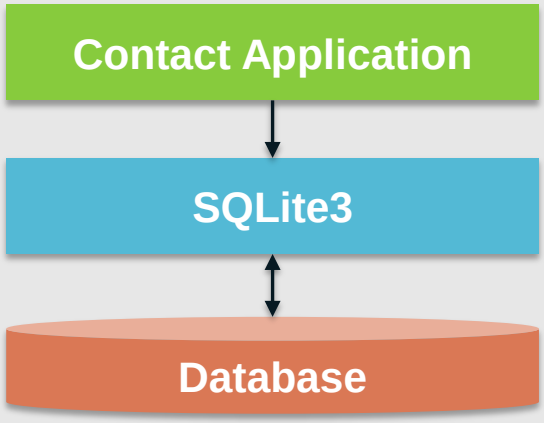


Practices of Database Usage

Database Engine in Tizen

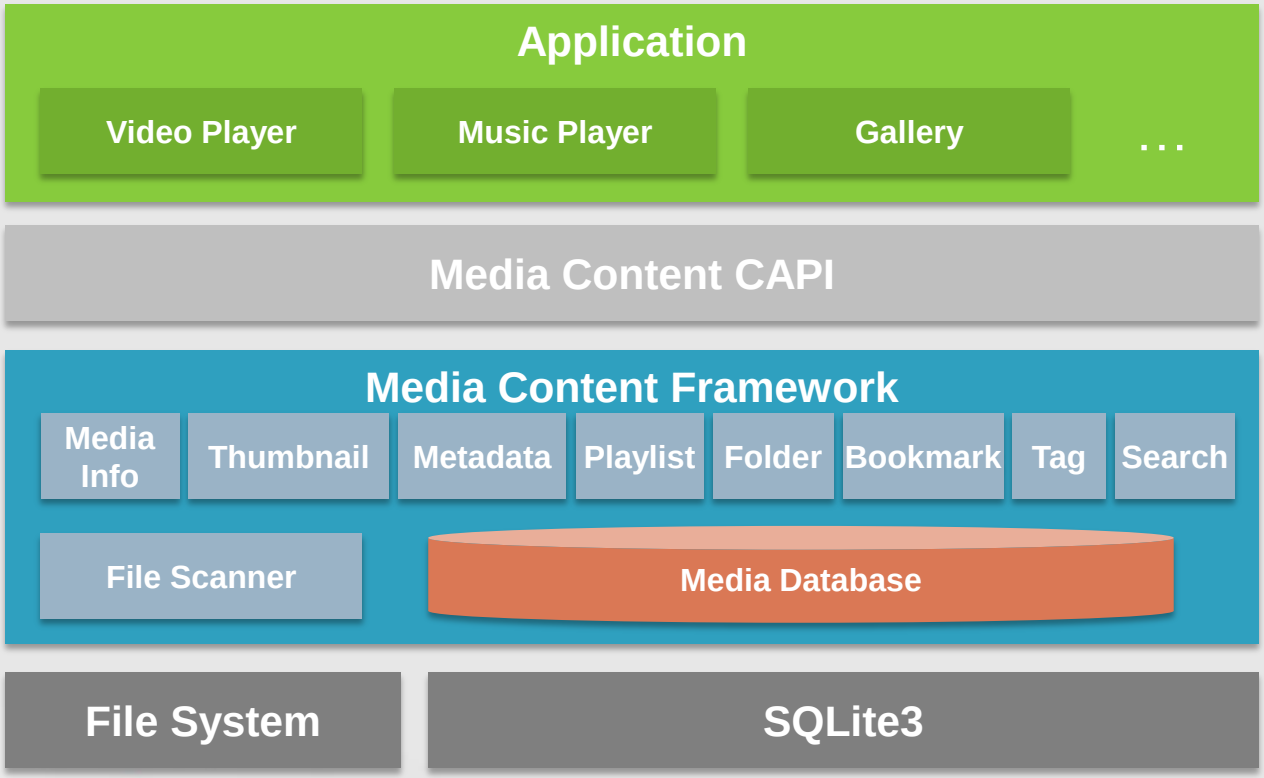
- **SQLite 3**
  - A popular choice as embedded database
  - No wrapper in Tizen platform

- **Practices of SQLite3**
  - Concurrency control
    - Use mutex in application side
  - API usage in application
    - sqlite3_exec()
    - sqlite3_prepare_v2() & sqlite3_step()

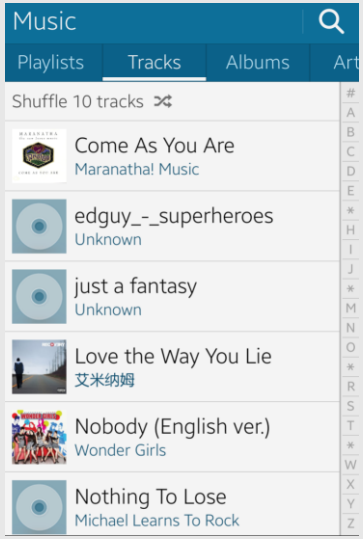


Media Content Framework

- CRUD media information from/to database
- Managed content: image/video/audio files



Case Study: Music Player with Media Content



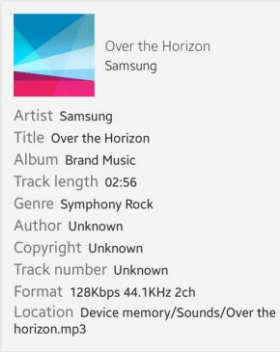
Get media info

```
…
/* initialize */
media_content_connect(…);
/* create filter */
filter = media_filter_create(…);
/* get audio file count */
media_info_get_media_count_from_db(…);
/* set filter property (SQL prepare) */
media_filter_set_order(…);
media_filter_set_condition(…);
media_filter_set_offset(...);
/* query audio file list from media content */
media_info_foreach_media_from_db(…);
…
/* monitor audio file update */
media_content_set_db_updated_cb(…);
…
/* Finalize */
media_content_disconnect(…);
…
```

Get Metadata

```
…
/* initialize */
media_content_connect(…);
media_info_get_media_from_db(…);
media_info_get_audio(…);

audio_meta_get_sample_rate(…);
audio_meta_get_duration(…);
…
/* Finalize */
media_content_disconnect(…);
…
```




Thanks!

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