Overview of the Tizen Native Application Framework

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Introduction
Introduction

- Tizen has 2 frameworks: Web and native

### Tizen Web framework
- **Web application**
  - W3C / HTML5
    - Video
    - Touch
  - CSS3
  - WebGL
  - Worker
  - Device APIs
    - BT
    - NFC
    - Msg
  - Web UI F/W
  - Web Runtime

### Tizen native framework
- **Native application**
  - App
  - Base / Io
  - Security
  - System
  - Multimedia
  - Connectivity
  - Text / Locales
  - Messaging
  - Social
  - Media
  - Web

### Core
- **Shell**
- **Framework**
- **Core**

### Linux Kernel and device drivers
Introduction

- **Tizen native framework (released with Tizen 2.0):**
  - Supports full-featured native app development and provides a variety of features, such as background service, IP push, and TTS
  - Provides a chance to reuse existing C/C++ engines and libraries in writing apps
  - Includes popular standard open source libraries:
    - glibc, libstdc++, libxml2, Open GL® ES, Open AL®, Open MP®

![Tizen Web framework diagram]

![Tizen native framework diagram]
Introduction

- **Tizen native application framework provides:**
  - Package installation, uninstallation, and upgrading
  - Application model of the native framework
  - Application life-cycle management
  - System event handlers for applications
  - Application configuration management
  - And more…
Application (Basic)
Application | Package

• **Package**
  • Container of executable binaries and content
  • Package has a `PackageId`, a global unique ID of the package

• **App**
  • Base class of an executable entity as a process
  • An App has:
    • `AppId`, global unique ID of the App
    • `AppName`, locale-independent name of the App
    • `AppVersion` (shared among all Apps in a package)
    • `AppResource` (shared among all Apps in a package)
    • `Privilege` (shared among all Apps in a package)
Application | Package

- **Tizen::App::Package::PackageManager**
  - Install, uninstall, and upgrade packages
  - Retrieve information related to the packages that are installed on the device
Application | Package

- **Root directory:**
  - `/opt/ usr/ apps/ [PackageId]`
  - All Apps in the package share the root directory.
Application | Package

- **Upgrade policy**
  - All read-only files are removed
  - All the files in writable directories are overwritten

<table>
<thead>
<tr>
<th>Directory</th>
<th>Upgrade policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>[App Root]/bin</td>
<td>These files (binaries, resources, icons, and information files) are read-only. The files are deleted and replaced with the upgraded files.</td>
</tr>
<tr>
<td>[App Root]/res</td>
<td></td>
</tr>
<tr>
<td>[App Root]/shared/res</td>
<td></td>
</tr>
<tr>
<td>[App Root]/info</td>
<td></td>
</tr>
<tr>
<td>[App Root]/lib</td>
<td></td>
</tr>
<tr>
<td>[App Root]/shared/res</td>
<td></td>
</tr>
<tr>
<td>[App Root]/data</td>
<td>These files are writable files. All files are not removed. The existing file is overwritten by a new file if they have the same name.</td>
</tr>
<tr>
<td>[App Root]/shared/data</td>
<td></td>
</tr>
<tr>
<td>[App Root]/shared/trusted</td>
<td></td>
</tr>
<tr>
<td>[App Root]/setting</td>
<td></td>
</tr>
</tbody>
</table>
There are 2 types of Tizen native applications:

- **UI application**
  - Has a graphical user interface
  - Inherits from the `Tizen::App::UiApp` class
  - Handles the `OnForeground`/`OnBackground` events

- **Service application**
  - Has no graphical user interface
  - Inherits from the `Tizen::App::ServiceApp` class
  - Runs on background
<table>
<thead>
<tr>
<th>Definition</th>
<th>UI application</th>
<th>Service application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Application with UI</td>
<td>Application without UI</td>
</tr>
<tr>
<td>Base class</td>
<td>Tizen::App::UiApp</td>
<td>Tizen::App::ServiceApp</td>
</tr>
<tr>
<td>Launched by</td>
<td>Main menu, task switcher, other apps, or condition</td>
<td>On booting, other apps, or condition</td>
</tr>
<tr>
<td>Main menu icon</td>
<td>Visible</td>
<td>Invisible</td>
</tr>
<tr>
<td>Task switcher</td>
<td>Visible</td>
<td>Visible (separate)</td>
</tr>
<tr>
<td>Foreground</td>
<td>Possible</td>
<td>Impossible</td>
</tr>
<tr>
<td>Background</td>
<td>Possible</td>
<td>Always</td>
</tr>
<tr>
<td>Tag in the manifest file</td>
<td>&lt;UiApp&gt;&lt;/UiApp&gt;</td>
<td>&lt;ServiceApp&gt;&lt;/ServiceApp&gt;</td>
</tr>
</tbody>
</table>
Application | Life-cycle

- **Create**
  - **Initializing**
    - **OnAppInitializing**() return true
      - Call the **OnAppInitialized**() handler.
    - **OnAppInitializing**() return false
      - Call the **OnAppInitializing**() handler.
  - **Running**
    - **OnAppWillTerminate**() return true
      - Destroy allocated resources.
      - Call the **OnAppTerminating**() handler.
    - **OnAppWillTerminate**() return false
      - Exit event loop.
  - **Terminating**
    - **OnAppWillTerminate**() return false
      - Exit event loop.
    - **OnAppTerminating**() return true
      - Destroy allocated resources.
      - Call the **OnAppTerminating**() handler.
Application | Life-cycle (UI Application)

Create

Initialize

OnAppInitializing()

OnAppInitialized()

AddFrame()

OnInitializing()

OnWindowActivated()

OnWindowStateChanged()

OnForeground()

OnBackground()

OnAppWillTerminate()

OnAppTerminating()

OnWindowDeactivated()

End key is pressed

Return false

Terminate

OnAppTerminating()

RemoveFrame()

OnWindowDeactivated()

OnWindowStateChanged()

OnWindowDeactivated()
Application | Life-cycle – Launching (1/2)

- An application is launched when:
  - User clicks the icon in the main menu
  - Other application requests launching using launch-related APIs:
    - Tizen::App::AppManager::LaunchApplication
    - Tizen::App::AppManager::RegisterAppLaunch
    - Tizen::App::AppControl::Start
    - Tizen::Shell::NotificationManager::NotifyByAppId

- In the application initialization phase:
  - System loads the necessary libraries and the app executable binary to the memory
  - App instance is created and executed
  - In the OnAppInitializing() handler resources, UI components, and previous app states can be loaded or initialized
• Implementing `OnAppInitializing()`:

```cpp
bool BasicApp::OnAppInitializing(AppRegistry& appRegistry)
{
    int lastPanelId = 0;
    ...

    result r = appRegistry.Get(panelIDkey, lastPanelId);
    ...
    r = appRegistry.Get(panelNamekey, lastPanelName);
    ...
    // Create & add a Frame
    BasicAppFrame* pBasicAppFrame = new (std::nothrow) BasicAppFrame();
PBasicAppFrame->Initialize(lastPanelId);
PBasicAppFrame->SetName(L"BasicApp");
    AddFrame(*pBasicAppFrame);
}
return true;
```
Application | Life-cycle – Termination (1/2)

- Application is terminated when
  - The `Tizen::App::Terminate()` method is called
  - Another application requests termination by calling the `Tizen::App::AppManager::TerminateApplication()` method
  - The application is in the foreground and the user presses the END key
  - The user selects “End” in the task switcher
  - The number of concurrent Tizen applications exceeds the limitation defined by the system policy
  - The system memory or power is extremely low
Application | Life-cycle – Termination (2/2)

• In the `OnAppTerminating()` handler, the following requirements must be met:
  • Application returns quickly
  • Application frees the resources it has been using to avoid memory leakage
  • Application closes all pending connections to servers
  • App can save its state through the `AppRegistry` class

```cpp
bool BasicApp::OnAppTerminating(AppRegistry& appRegistry, bool forcedTermination)
{
    String panelIDkey(L"AppLastPanelId");
    String panelNamekey(L"AppLastPanelName");

    appRegistry.Add(panelIDkey, lastPanelId);
    appRegistry.Add(panelNamekey, lastPanelName);

    return true;
}
```
Application | Life-cycle - Foreground

- Application is visible when it is in the foreground state
  - Application is brought to the foreground from the background when:
    - Application is selected from the task switcher
    - Application icon is selected in the main menu
  - When an application is changed to be visible, the `OnForeground()` handler is called
- When the application is brought to the foreground:
  - Application is recommended to handle graphics processing (3D or animation) since the application becomes visible
  - It is better to resume other operations that were stopped when the application was last moved to the background.
Application | Life-cycle - Background

- **Application is invisible when it is in the background state**
  - An application is sent to the background:
    - When another application pops up and hides current application frame (for example, the user presses the HOME key, and the main menu is displayed)
  - When the application is sent to the background:
    - Graphics processing (such as 3D or animation) is better to be stopped since the graphics are not being displayed
    - It is recommended to release unnecessary resources and stop media processing and sensors manipulation

Call the `OnForeground()` handler.

Call the `OnBackground()` handler.
Application | Life-cycle – System Event Handling

- Application can receive various system events
  - Battery events
    - `OnBatteryLevelChanged()` handler
    - It is recommended that the application consuming more battery power is terminated if the battery level is `Tizen::System::BATTERY_LEVEL_CRITICAL`
  - Memory events
    - When the system-wide memory or application heap memory is insufficient to run the application any further, the `OnLowMemory()` handler is called to free unused memory resources
  - Screen events
    - `OnScreenOn()`/`OnScreenOff()` handlers
    - The resources must be handled efficiently by the `OnForeground/OnBackground` and `OnScreenOn/OnScreenOff` event handlers. Do not to duplicate or delete resources
• **AppRegistry**
  • App can save or restore its custom states, such as user preferences, configuration information, and current game scores
  • Key-value-style data accessing
  • Supported operations: Add, Set, Get, Remove
  • Supported data types: String, Int, Double

```cpp
bool BasicApp::OnAppInitializing(AppRegistry & appRegistry)

bool BasicApp::OnAppTerminating(AppRegistry & appRegistry,...)
```
**Application | Configuration (2/3)**

- **AppResource**
  - `GetString()` : Load string resources for localization

```plaintext
/res/eng-GB.xml
/res/deu-DE.xml
/res/ita-IT.xml
/res/kor-KR.xml
```

- `Locale` : Gets language and country code

- **GetBitmapN()** : Load graphics resources for multi-resolution (for example, HD and WVGA bitmap resources)
Application | Configuration (3/3)

- **AppSetting**
  - System setting provides setting menu for downloaded applications
  - You can design your own setting menu with IDE
  - Application can access setting values using the `Tizen::App::AppSetting` class
Application (Advanced)
Conditional Application Launch

- Application can register a launching condition for itself or other applications
- Framework launches a registered application when the condition is matched

<table>
<thead>
<tr>
<th>Type</th>
<th>Condition format</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>L&quot;DateTime='mm/dd/yyyy hh:mm:ss'&quot;</td>
<td>Launch at the wall time, 'mm/dd/yyyy hh:mm:ss'. The time format matches the output format of the Base::DateTime::ToString() method.</td>
</tr>
<tr>
<td></td>
<td>L&quot;DueTime='mm/dd/yyyy hh:mm:ss'LaunchPeriod='mm'&quot;</td>
<td>Launch at the wall time, 'mm/dd/yyyy hh:mm:ss', and every 'mm' minutes. The launch period must be between 60 minutes and 10 years.</td>
</tr>
<tr>
<td>Serial</td>
<td>L&quot;Serial='keyword'&quot;</td>
<td>Launch when receiving a keyword as serial communication input.</td>
</tr>
<tr>
<td>NFC</td>
<td>L&quot;NFC='command'&quot;</td>
<td>Launch when receiving command, as an NFC tag with NFC Data Exchange Format (NDEF) data.</td>
</tr>
</tbody>
</table>
Inter-application Operation | AppControl (1/2)

- Application can use an exported functionality by other application
- Functionality is defined by:
  - Operation ID
  - URI
  - MIME type
- AppControl resolution:
  - Explicit AppControl resolution
    - Tizen::App::AppManager::FindAppControlN()
    - By AppId or operation ID
  - Implicit AppControl resolution
    - Tizen::App::AppManager::FindAppControlsN()
    - By operation ID, URI, MIME type, or category

```cpp
String telUrl = L"tel:1234567900";
AppControl* pAc = AppManager::FindAppControlN(
    L"tizen.phone",
    L"http://tizen.org/appcontrol/operation/dial");
pAc->Start(&telUrl, null, null, null);
```
### Inter-application Operation | AppControl (2/2)

- **Platform defined AppControl Operation IDs:**

<table>
<thead>
<tr>
<th>Operation ID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://tizen.org/appcontrol/operation/main">http://tizen.org/appcontrol/operation/main</a></td>
<td>Reserved for application main entry point</td>
</tr>
<tr>
<td><a href="http://tizen.org/appcontrol/operation/call">http://tizen.org/appcontrol/operation/call</a></td>
<td>Make a call to the specified phone number</td>
</tr>
<tr>
<td><a href="http://tizen.org/appcontrol/operation/create_content">http://tizen.org/appcontrol/operation/create_content</a></td>
<td>Create content, such as an image captured with the camera</td>
</tr>
<tr>
<td><a href="http://tizen.org/appcontrol/operation/compose">http://tizen.org/appcontrol/operation/compose</a></td>
<td>Compose the content</td>
</tr>
<tr>
<td><a href="http://tizen.org/appcontrol/operation/dial">http://tizen.org/appcontrol/operation/dial</a></td>
<td>Launch the dial screen for making a call</td>
</tr>
<tr>
<td><a href="http://tizen.org/appcontrol/operation/multi_share">http://tizen.org/appcontrol/operation/multi_share</a></td>
<td>Share multiple content items</td>
</tr>
<tr>
<td><a href="http://tizen.org/appcontrol/operation/pick">http://tizen.org/appcontrol/operation/pick</a></td>
<td>Display the list of items and return the selected item</td>
</tr>
<tr>
<td><a href="http://tizen.org/appcontrol/operation/share">http://tizen.org/appcontrol/operation/share</a></td>
<td>Share the content</td>
</tr>
<tr>
<td><a href="http://tizen.org/appcontrol/operation/view">http://tizen.org/appcontrol/operation/view</a></td>
<td>Display or play the content</td>
</tr>
</tbody>
</table>
Inter-application Operation | DataControl

- Application can use shared data by other application:
  - Use the `Tizen::Io::File` for `[App Root]/shared/data` directory
  - Use DataControl
- DataControl types:
  - `Tizen::App::SqlDataControl`
    - Use SQL-type data access
  - `Tizen::App::MapDataControl`
    - Use key-value-type data access
- DataControl resolution
  - Explicit, by provider ID and data ID
Inter-application Operation | Message Port

• Application can send and receive messages through a message port

• Message port types:
  • `Tizen::Io::RemoteMessagePort`
    • Send messages to other applications
  • `Tizen::Io::LocalMessagePort`
    • Receive messages from another application

```
RemoteMessagePort::SendMessage(localPort)
IMessagePortListener::OnMessageReceivedN(remotePort)
```
System Information

• Tizen::System::SystemInfo
  • GetBuildInfo()
  • GetPlatformVersion()
  • GetValue()

<table>
<thead>
<tr>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://tizen.org/feature/camera">http://tizen.org/feature/camera</a></td>
</tr>
<tr>
<td><a href="http://tizen.org/feature/camera.back">http://tizen.org/feature/camera.back</a></td>
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<td><a href="http://tizen.org/feature/camera.back.flash">http://tizen.org/feature/camera.back.flash</a></td>
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<td><a href="http://tizen.org/feature/camera.front">http://tizen.org/feature/camera.front</a></td>
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<td><a href="http://tizen.org/feature/database.encryption">http://tizen.org/feature/database.encryption</a></td>
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<td><a href="http://tizen.org/feature/graphics.acceleration">http://tizen.org/feature/graphics.acceleration</a></td>
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<td><a href="http://tizen.org/feature/microphone">http://tizen.org/feature/microphone</a></td>
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<td><a href="http://tizen.org/feature/multi_point_touch.pinch_zoom">http://tizen.org/feature/multi_point_touch.pinch_zoom</a></td>
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<td><a href="http://tizen.org/feature/multi_point_touch.point_count">http://tizen.org/feature/multi_point_touch.point_count</a></td>
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<td><a href="http://tizen.org/feature/network.nfc">http://tizen.org/feature/network.nfc</a></td>
</tr>
<tr>
<td><a href="http://tizen.org/feature/network.nfc.reserved_push">http://tizen.org/feature/network.nfc.reserved_push</a></td>
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<tr>
<td><a href="http://tizen.org/feature/network.push">http://tizen.org/feature/network.push</a></td>
</tr>
<tr>
<td><a href="http://tizen.org/feature/network.secure_element">http://tizen.org/feature/network.secure_element</a></td>
</tr>
<tr>
<td>... more ...</td>
</tr>
</tbody>
</table>
System Information

- **Tizen::System::SettingInfo**
  - `SetValue()`
  - `SetValueAsync()`
  - `GetValue()`
  - Application can set an event listener

<table>
<thead>
<tr>
<th>Key</th>
</tr>
</thead>
<tbody>
<tr>
<td><a href="http://tizen.org/setting/application.home">http://tizen.org/setting/application.home</a></td>
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<tr>
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<td><a href="http://tizen.org/setting/contacts.order.firstname">http://tizen.org/setting/contacts.order.firstname</a></td>
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<tr>
<td><a href="http://tizen.org/setting/developer.usb_debugging">http://tizen.org/setting/developer.usb_debugging</a></td>
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<tr>
<td><a href="http://tizen.org/setting/device_name">http://tizen.org/setting/device_name</a></td>
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<tr>
<td>... more ...</td>
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</tbody>
</table>
System Information

- **Tizen::System::RuntimeInfo**
  - **GetValue()**
  - **GetValueAsync()**

<table>
<thead>
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<th>Key</th>
<th>Value</th>
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