MEDIATEK Confidential Release for Vogins WCX(vendor)

Confidential B

Venus UI Training

MEDIATEK Confidential Release for Vogins WCX(vendor)

Copyright © MediaTek Inc. All rights reserved.

MEDIATEK Confidential Release for Vodins WCX(vendor)

Outline

- Introduction to Fancy UI
- Venus UI Engine Architecture
- Hello World!
- Basic Type Classes
  - Base C++ Support
- PME Engine:
  - Venus Object Model
  - Event Engine
- MVC Engine:
  - Building Scene Graph
  - Animation
  - Control and Input
  - Timer

MEDIATEK Confidential Release for Vodins WCX(vendor)

MEDIATEK Confidential Release for Vogins WCX(vendor)

Confidential B

MEDIATEK

Introduction to Fancy UI

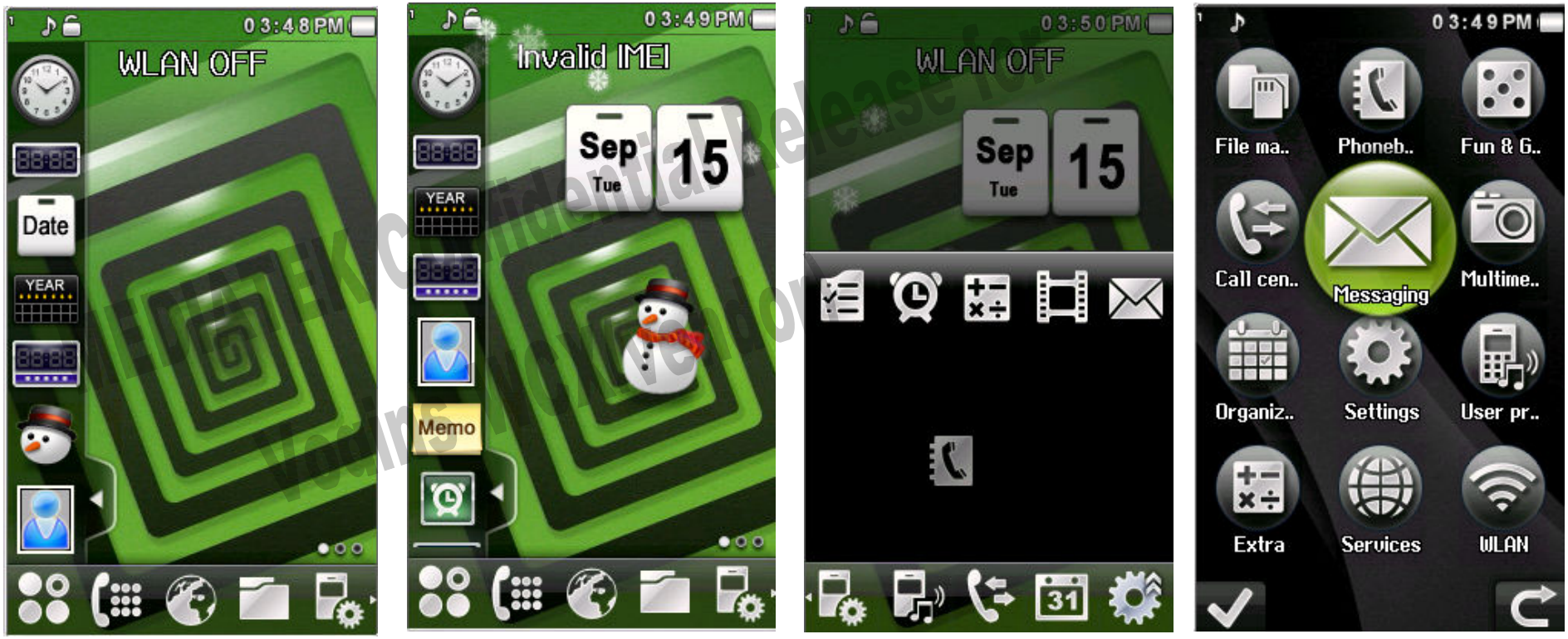
MEDIATEK Confidential Release for Vogins WCX(vendor)

Copyright © MediaTek Inc. All rights reserved.

MEDIATEK Confidential Release for Vodafone WCX(vendor)

What is Venus UI

- A fancy UI system
  - easier to leverage hardware acceleration
  - Flexible animation effects



MEDIATEK Confidential Release for Voqins WCX(vendor)

Factors of "Fancy UI Engine"

- **Another high priority rendering task**
  - Rendering task handle UI display. MMI task only take care UI logic.
  - Rendering task have HW accelerator domain knowledge.
  - Rendering task provide stable FPS of UI animation but will impact MMI slow down the event/logic handling.
- **Canvas base design concept**
  - Easy partial update UI content without impact other area.
- **Scene graph handled by rendering task**
  - Scene graph is a light version of component tree
  - Scene graph only keeps UI display information without state/logic
- **UI animation base on scene graph**
  - Rendering task will handle each intermediate state of UI animation.
  - MMI task only take care the animation begin/end state.

MEDIATEK Confidential Release for Voqins WCX(vendor)

MEDIATEK Confidential Release for Vogins WCX(vendor)

Confidential B

MEDIATEK

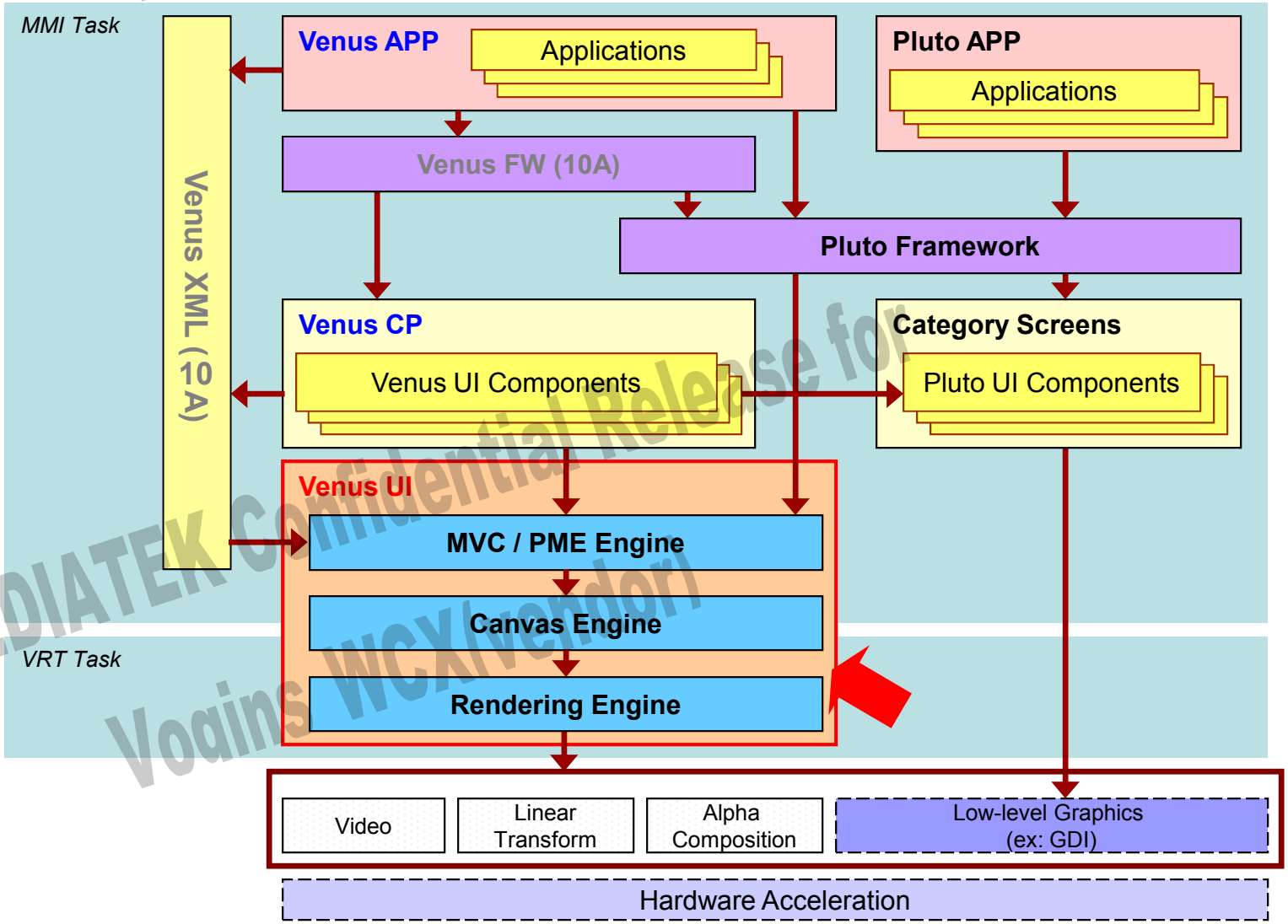
Venus UI Engine Architecture

MEDIATEK Confidential Release for Vogins WCX(vendor)

Copyright © MediaTek Inc. All rights reserved.

MEDIATEK Confidential Release for Vogins WCX(vendor)

Venus UI Architecture



MEDIATEK Confidential Release for Vogins WCX(vendor)

MEDIATEK Confidential Release for Vogins WCX(vendor)

Brief of Architecture – VRT

- Rending Engine
  - A higher priority task than MMI Task
    - Will not be blocked by MMI Task.
    - Ex: MMI will be blocked when reading a file.
  - Rendering Canvas-based Scene Graph and output to LCD
    - Optimized with HW accelerator
- Canvas Engine
  - Provides low level API for VFX
    - APP does not touch these APIs
  - Passes Scene Graph to rendering task on MMI task
  - Maintains VRT states and resources

MEDIATEK Confidential Release for Vogins WCX(vendor)

MEDIATEK Confidential Release for Vodins WCX(vendor)

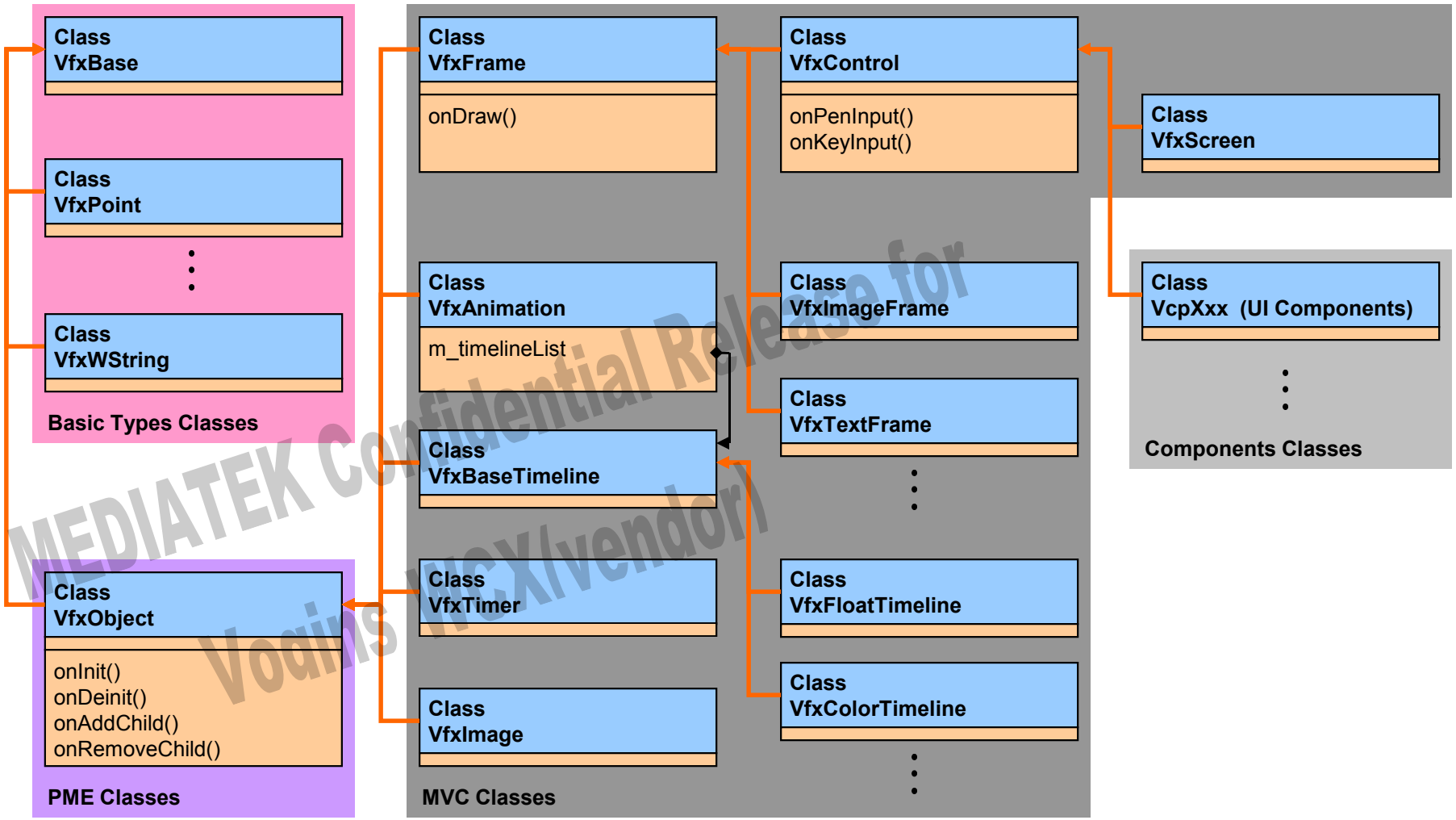
Brief of Architecture – VFX

- Basic Types Classes:
  - Define the base class
  - Define operator new and delete
  - Provide basic type classes (point, string, etc.)
- PME Engine:
  - Define the base object class
  - Provide Venus Property-Method-Event Model
  - Provide object memory management mechanisms
- MVC Engine: (Model-View-Controller)
  - Provide visual and animation mechanisms
  - Define base control class
  - Dispatch input events

MEDIATEK Confidential Release for Vodins WCX(vendor)

MEDIATEK Confidential Release for Voqins WCX(vendor)

VFX Classes



MEDIATEK Confidential Release for Voqins WCX(vendor)

Scene Graph Committing

- Venus UI Engine collects all changes and commit to VRT at once, ex:
  -
```
void VcpMyObj::doSomting()
{
    m_someChild->setPos(pos1);    // ignored
    …
    m_someChild->setPos(pos2);
}
```

- APP should not expect any change will be displayed directly.
- Commit Timing:
  - All changes will be committed exactly after function call stacks
  - (The detail at the chapter *Timer*)

MEDIATEK Confidential Release for Yoolins WCX(vendor)

Memory Management

- Venus use dynamic memory allocation to create objects
- Memory pools:
  - Global Memory
    - For internal system objects
  - Context Memory
    - APP provide a block of memory to be a memory pool
    - For APP objects
    - Source can be any memory source
      - ex. APP ASM, Screen ASM, Global Memory, …

MEDIATEK Confidential Release for Vodins WCX(vendor)

MEDIATEK Confidential Release for Voqins WCX(vendor)

Confidential B

MEDIATEK

Hello World!

MEDIATEK Confidential Release for Voqins WCX(vendor)

Copyright © MediaTek Inc. All rights reserved.

Example: Hello World

```
class VtstHelloScr : public VfxAppCatScr
{
// Constructor / Destructor
public:
    // Default constructor
    VtstHelloScr() {}

// Override
protected:
    virtual void onInit();
};


void VtstHelloScr::onInit()
{
    VfxAppCatScr::onInit();

    /*
     * Setup the background color
     */
    setBgColor(VFX_COLOR_BLUE);

    /*
     * Add a text frame to screen
     */
    VfxTextFrame *textFrame;
    VFX_OBJ_CREATE(textFrame, VfxTextFrame, this);
    textFrame->setPos(10, 10);
    textFrame->setString(VFX_WSTR("Hello World!"));
}
```

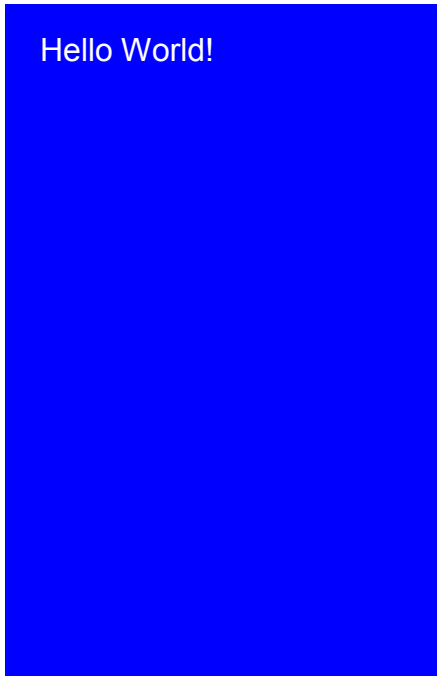
Override
APP Category Screen

Callback on after screen created

Remember call the super class's method

Initialize the screen's property

1. Create from the screen's memory pool
2. Add as the screen child



MEDIATEK Confidential Release for Vendors WCX(vendor)

Example: Hello World (Cont.)

```
static VfxAppCatScr *g_vtstScrPtr = NULL;

void vtst_main_entry(void)
{
    EntryNewScreen(VTST_MAIN_SCR_DUMMY, vtst_main_leave, NULL, NULL);

    /* Enter the APP category screen */

    VfxAppCatScr::initalize();

    VFX_OBJ_CREATE(
        g_vtstScrPtr,
        VtstHelloScr,
        VfxAppCatScr::getContext());
}

void vtst_main_leave(void)
{
    /* Leave the APP category screen */

    VFX_OBJ_CLOSE(g_vtstScrPtr);

    VfxAppCatScr::deinitalize();
}
```

Prepare resource to enter an APP Category Screen

Create the 'Hello World' Screen on the default memory pool (Screen ASM)

Destroy the 'Hello World' Screen

Leave and release APP Category Screen resources

MEDIATEK Confidential Release for Vodins WCX(vendor)

MEDIATEK Confidential Release for Vogins WCX(vendor)

Confidential B

MEDIATEK

Basic Type Classes: Base C++ Support

MEDIATEK Confidential Release for Vogins WCX(vendor)

Copyright © MediaTek Inc. All rights reserved.

Basic Types

- Primitive Types:
  - VfxBool, VfxS32, …
- C++ Base
  - VfxBase
- Geometry Basic Type Classes:
  - VfxPoint, VfxRect, …
- Resource Types:
  - VfxWString
  - VfxImageSrc
  - VfxFontDesc
  - …

MEDIATEK Confidential Release for Vegins WCX(vendor)

MEDIATEK Confidential Release for Voqins WCX(vendor)

VfxBase

- VfxBase is the base of all class in the Venus, all classes **must** inherit from this class.
- Features:
  - Provides operator new and delete
  - **No** default virtual destructor

MEDIATEK Confidential Release for Voqins WCX(vendor)

VfxBase: Notice

- Do not new an object which does not inherit from VfxBase
- Do not create a global object with constructor
  - Include 'global objects', 'static member objects' or 'static objects in a function'
- Do not use *operator new []* (new object array)
- Use Venus macros, ex. *VFX_NEW* , to create or destroy an object
  - For memory log

MEDIATEK Confidential Release for Vogins WCX(vendor)

Geometry Basic Type Classes

- Classes:
  - VfxColor
  - VfxPoint
  - VfxSize
  - VfxRect
  - VfxTransform
  - VfxFPoint
- Features:
  - Constructor, copy constructor, and assign operators
  - Rectangle contains test
  - Rectangle intersect and union operators
  - (See SAP)

MEDIATEK Confidential Release for Verifins WCX(vendor)

VfxWString

- Features:
  - Automatically allocate and free string buffer
  - Provide string's basic operations,
    - ex: get length、concatenate and etc.
  - Generate with C format (%s, %d, …)
- Supported string source types:
  - Null: Default constructer, create a null string
  - Constant string: Ex. `VFX_WSTR("Hello")`
  - Resource ID: Ex. `VFX_WSTR_RES(STR_ID_OK)`
  - Dynamic String: Ex. `VFX_WSTR_MEM(buffer)`

MEDIATEK Confidential Release for Vodafone WCX(vendor)

VfxFontDesc

- Features:
  - A structure that describes a font style
  - Helper functions: ex. `measureStr()`
  - Support Vector Font Size ex. `font.size = VFX_FONT_DESC_VF_SIZE(24)`
- Members:
  - Size: ex. Small, Medium, Large, etc.
  - Attribute Flags: ex. Bold, Italic, etc.
  - Effect: ex. Border, Engrave, etc.
- Example:

```
void MyScr::onDraw(VfxDrawContext &dc)
{
    VfxFontDesc font(VFX_FONT_DESC_SIZE_SMALL);
    dc.setFont(font);
    dc.drawText(10, 10, VFX_WSTR("HELLO"));
}
```

MEDIATEK Confidential Release for Vegins WCX(vendor)

MEDIATEK Confidential Release for Vogins WCX(vendor)

VfxImageSrc

- Features:
  - Descript a image source
  - Helper functions: ex. `getSize()`
- Support image source types:
  - Null: Default constructor
  - Resource ID: ex. `VfxImageSrc(IMG_ID_L1)`
  - Path: ex. `VfxImageSrc(VFX_WSTR("d:\\1.jpg"))`
  - Image Buffer
- Example:

```
– void MyScr::onDraw(VfxDrawContext &dc)
  {
      VfxImageSrc img(IMG_GLOBAL_L1);
      dc.drawImage(10, 100, img);
  }
```

MEDIATEK Confidential Release for Vogins WCX(vendor)

Confidential B

PME Engine: Venus Object Model

MEDIATEK Confidential Release for Vogins WCX(vendor)

Copyright © MediaTek Inc. All rights reserved.

MEDIATEK Confidential Release for Yoogins WCX(vendor)

VfxObject

- VfxObject is base class for PME model
- Features:
  - Default Virtual Destructor
  - Provide class Information (See RTTI) (dynamic cast / dynamic data access)
  - Parent-Child Hierarchy Model
  - Weak Pointer
  - Support XML (10A)
- Class Information:
  - Can easily use macro *VFX_DECLARE_CLASS* and *VFX_IMPLEMENT_CLASS to define*

Only if the class need RTTI

MEDIATEK Confidential Release for Yoogins WCX(vendor)

Example: Define Class Information

```
class VfxTestObj : public VFxTestObjParent
{
    VFX_DECLARE_CLASS(VfxTestObj);

public:
    /*
     * constructor
     */
    VfxTestObj()

    //...
};


VFX_IMPLEMENT_CLASS("Test", VfxTestObj , VFxTestObjParent);
```

MEDIATEK Confidential Release for Vodins WCX(vendor)

MEDIATEK Confidential Release for Vodins WCX(vendor)

Object Parent-Child Hierarchy Model

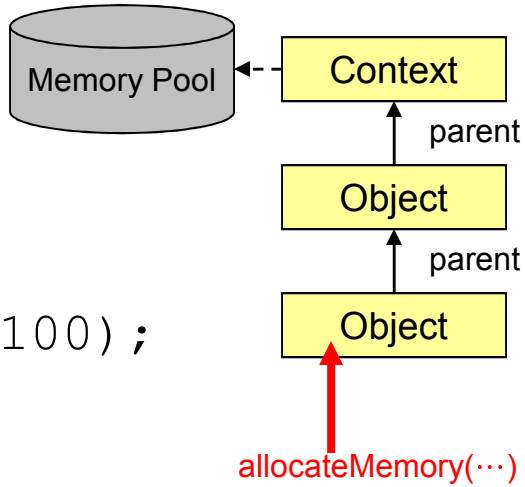
- Features:
  - Each object has a parent object.
  - When an object has been deleted, it also deletes its child objects.
- Virtual Functions:
  - `onAddChild()`
  - `onRemoveChild()`

MEDIATEK Confidential Release for Vogins WCX(vendor)

MEDIATEK Confidential Release for Vogins WCX(vendor)

VfxObject: Allocate Memory

- VfxObject implements IVfxAllocator interface
- The default implement is re-allocate from parent object
- Ex.
  -
```
void MyObject::foo()
{
    void *ptr = allocateMemory(100);

    …

    freeMemory(ptr);
}
```

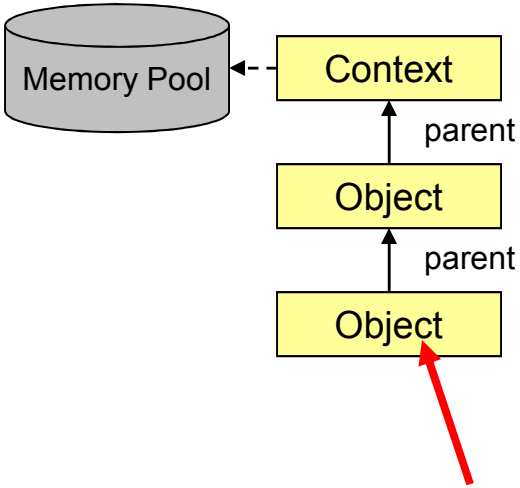


MEDIATEK Confidential Release for Vogins WCX(vendor)

MEDIATEK Confidential Release for Veapus WCX(vendor)

Create / Close an Object

- Macros:
  - **VF_OBJ_CREATE**(_ptr, _class_name, _parent)
    - Create an object and assign it's parent object
    - The object will be created on the memory pool of parent's root object.
  - **VF_OBJ_CREATE_EX**(_class_name, (_param), _parent)
  - **VF_OBJ_CLOSE**(_ptr)
    - Delete object and its child objects
    - Set _ptr to NULL
  - **VFX_OBJ_VALID_ASSERT**(_obj)
    - Assert if object is NULL or has been deleted
- Virtual Functions:
  - **onInit**()
    - Execute after C++ constructor
  - **onDeinit**()
    - Execute before C++ destructor



VF_OBJ_CREATE(_ptr, _class_name, **_parent**)

MEDIATEK Confidential Release for Veapus WCX(vendor)

MEDIATEK Confidential Release for Vogins WCX(vendor)

Example: Object Macros

```
class VcpMyControl : public VfxControl
{
public:
    …
    VfxTextFrame *m_controlText;
}

void VcpMyControl::VcpMyControl()
    m_controlText(NULL)
{
}

void VcpMyControl::onInit()
{
    VcpControl::onInit();

    VFX_OBJ_CREATE(m_controlText, VfxTextFrame, this);
    m_controlText->setPos(10, 10);
}
```

Reset to NULL

Remember call the super class's method

1. Create from the memory pool of root object
2. Add as the control's child

m_controlText will be deleted automatically

MEDIATEK Confidential Release for Vogins WCX(vendor)

MEDIATEK Confidential Release for Vodafone WCX(vendor)

RTTI

- **Run-Time Type Identification**
  - Keeps information about an object's data type in memory at runtime
  - Check an object whatever type in runtime
- Macros:
  - **`VFX_OBJ_DYNAMIC_CAST`**`(_ptr, _className)`
    - _ptr must inherit from *VfxObject*
    - class `_className` must implement class information
    - If *_ptr* is not inherit from *_class_name* or it's child class, it will return NULL, or it will return a type converted pointer
- Example:

```
VfxControl *myControl = VFX_OBJ_DYNAMIC_CAST(myFrame, VfxControl);
if (myControl != NULL)
{
    …
}
```

MEDIATEK Confidential Release for Vodafone WCX(vendor)

Weak Pointer

- When an object has been deleted, all weak pointer to this object will be NULL.
- A weak pointer is used like as a normal pointer usually.
- Prototype:
  - class template `VfxWeakPtr <T>`
- Operators:
  - `operator *`, `operator ->`
  - `operator ==`, `operator !=`
- Features:
  - `isValid()`
    - Return VFX_FALSE if the object has been deleted
  - `get()`
    - Return the object. It will return NULL if the object has been deleted

MEDIATEK Confidential Release for Vocins WCX(vendor)
MEDIATEK Confidential Release for Vocins WCX(vendor)

Example: Weak Pointer

- ```
  typedef VfxWeakPtr <VfxFrame> VfxFrameWeakPtr;
  ```

- ```
  class VcpMyControl : public VfxControl
  {
      //…
      VfxFameWeakPtr m_frameOtherPtr;
      //…
  }
  ```

- ```
  void VcpMyControl::assignFrame(VfxFrame *frame)
  {
      m_frameOtherPtr = frame;
  }
  ```

- ```
  void VcpMyControl::doSomething()
  {
      if (m_frameOtherPtr != NULL)
      {
          m_frameOtherPtr->someMethods(…);
      }
      else
      {
          //…
      }
  }
  ```

MEDIATEK Confidential Release for Vodins WCX(vendor)

MEDIATEK Confidential Release for Vogins WCX(vendor)

Confidential B

PME Engine: Event Engine

MEDIATEK Confidential Release for Vogins WCX(vendor)

Copyright © MediaTek Inc. All rights reserved.

MEDIATEK Confidential Release for Vocins WCX(vendor)

Signal & Slot

- Signal:
  - A signal like a callback function
  - It can be assigned with more than one callbacks
- Slot:
  - A slot is the callback function of signals
  - A slot must be a C++ object member function
- Connect:
  - It can connect one or more slots to a signal
- Emit:
  - When a signal be emitted, all connected slots will be callback.
- Post Emit:
  - Like emit, but all connected slots will be callback after this call stack.

MEDIATEK Confidential Release for Vocins WCX(vendor)

Post Emit

```
void MyButton::onDoClick()
{
    // Use post emit to callback all slots
    m_signalClick.postEmit(this);

    // Update some property…
    setBgColor(VFX_COLOR_RED);
    …
}
```

Other object can do anything, ex. delete the button or leave the screen.
After that, *this* point will be a dangling pointer...

So we need to use *postEmit* to callback after this call stack.

```
void OtherClassConnectToButton::onButtonClickSlot(VcpButton* button)
{
    VFX_OBJ_CLOSE(button);
}
```

MEDIATEK Confidential Release for Vodins WCX(vendor)

MEDIATEK Confidential Release for Vodins WCX(vendor)

VfxSignalX

- *VfxSignalX* are C++ template classes, currently X support from 0 to 4, is the number of event handler callback function argument
- Features:
  - **Compile-time type-safe callbacks in C++**
    - If a slot (callback function) doesn't match signal type, ex. parameter type doesn't match, it will have a compile error.
  - **Slots Connection and emit**
    - Use member method *connect()* to add a slot
    - Use member method dis*connect()* to remove a slot
    - Use member method *emit()* to callback all slots
    - Use member method *postEmit()* to callback all slots after this call stack (The detail at the chapter *Timer*)

MEDIATEK Confidential Release for Vodins WCX(vendor)

Example: Venus UI Event

```
class VfxTestObj : public VfxObject
{
public:
    VfxSignal0 m_eventArg0;
    VfxSignal1 <VfxFloat> m_eventArg1;
    VfxSignal2 <VfxFloat, VfxFloat> m_eventArg2;
    //...

    void test_event();
};

void VfxTestObj::testEvent()
{
    //...
    m_eventArg0.emit();
    m_eventArg1.emit(1);
    m_eventarg2.emit(2, 3);
}

void VfxTestOtherObj::onTestArg1a(VFxFloat arg1)
{
    m_memberData = arg1;
}


testObj->m_eventArg1.connect(otherTestObj, &VfxTestOtherObj::onTestArg1a);
testObj->m_eventArg1.connect(otherTestObj, &VfxTestOtherObj::onTestArg1b);

testObj->testEvent();
```

`otherTestObj->onTestArg1a()` and `otherTestObj->onTestArg1b()` will be called

MEDIATEK Confidential Release for Vogins WCX(vendor)

MEDIATEK Confidential Release for Vogins WCX(vendor)

Confidential B

MEDIATEK

MVC Engine: Building Scene Graph

MEDIATEK Confidential Release for Vogins WCX(vendor)

Copyright © MediaTek Inc. All rights reserved.

VfxFrame

- VfxFrame is a base class for a node of scene graph, inherit from VfxObject.
- Features:
  - Animatable properties
  - Frame coordinate
  - Frame-Tree hierarchy
  - Hit testing
  - Frame content
  - Auto animation
  - Optimization hints

MEDIATEK Confidential Release for Vodins WCX(vendor)

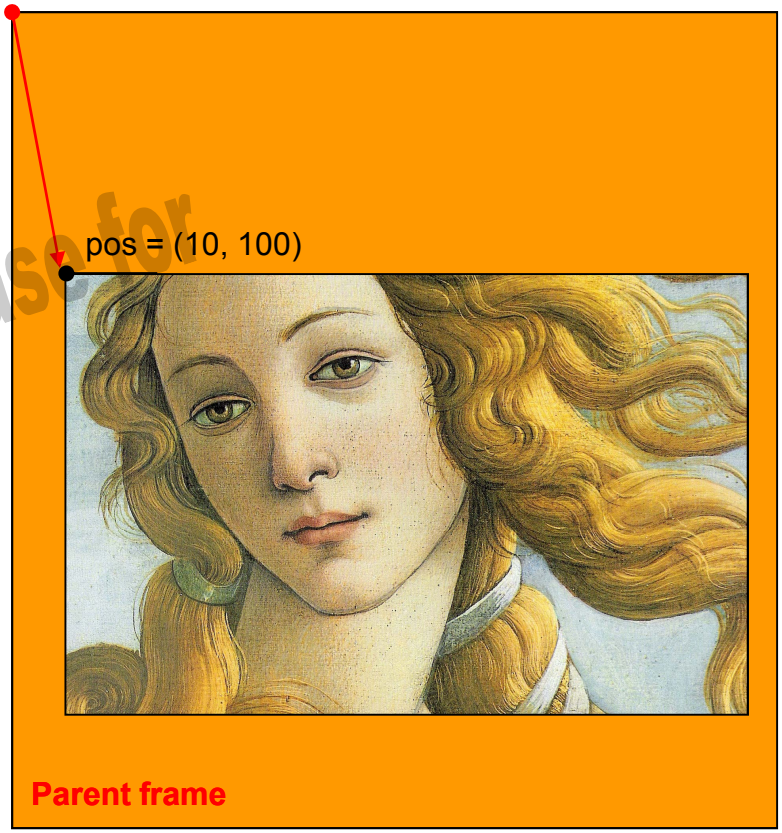
Animatable Properties

- VfxFrame properties are directly supported in the VRT.
- When a property is changed, it **automatically** update the screen output:
  - Ex: `menu->m_setPos(x, y);`
  - Ex: `wallpaper->setBgColor(VFX_COLOR_RED);`
- Some VfxFrame properties are animatable. **Animatable properties** can apply animations:
  - Position
  - Anchor Point
  - Bounds
  - Opacity
  - Transform
  - Background Color
  - Border Width
  - Border Color

MEDIATEK Confidential Release for Vesins WCX(vendor)
MEDIATEK Confidential Release for Vesins WCX(vendor)

MEDIATEK Confidential Release for Voqins WCX(vendor)

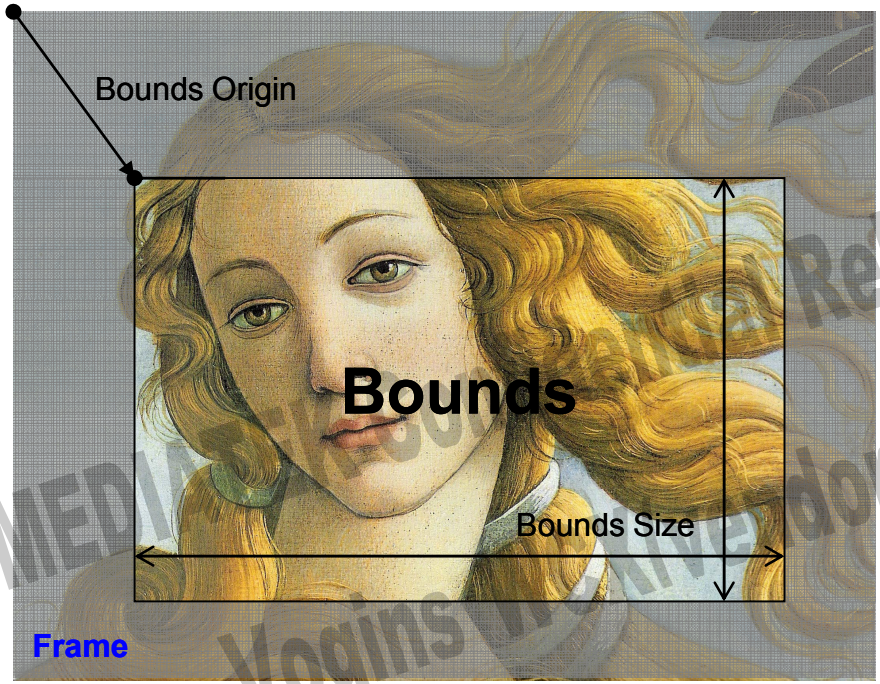
Frame Position



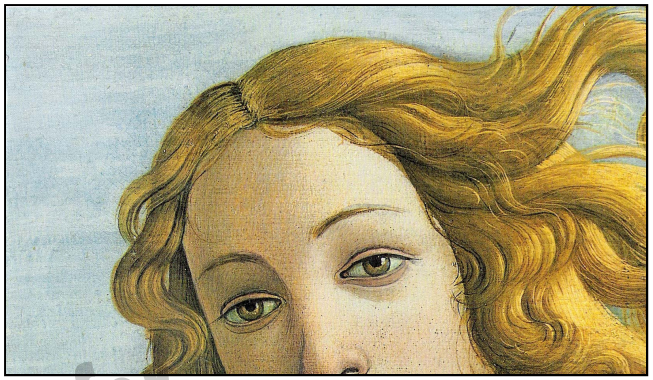
MEDIATEK Confidential Release for Voqins WCX(vendor)

MEDIATEK Confidential B
Yoqins WCX(vendor)

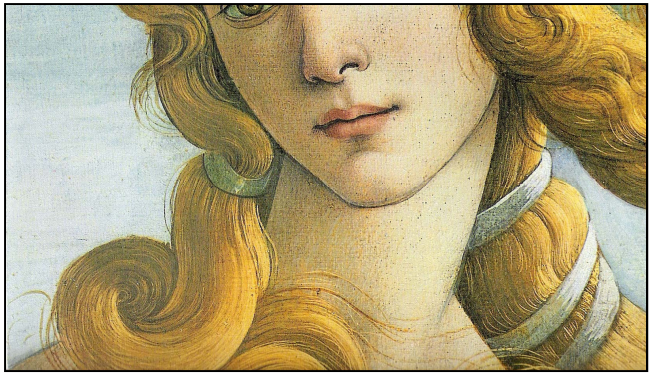
Frame Bounds



bounds.orign = (20, 30)
bounds.size = (100, 70)



bounds.orign = (0, 0)
bounds.size = (100, 70)

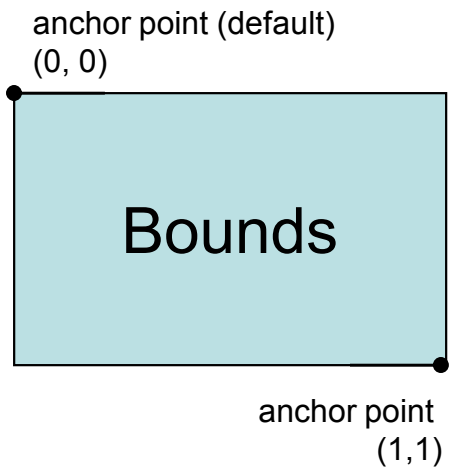


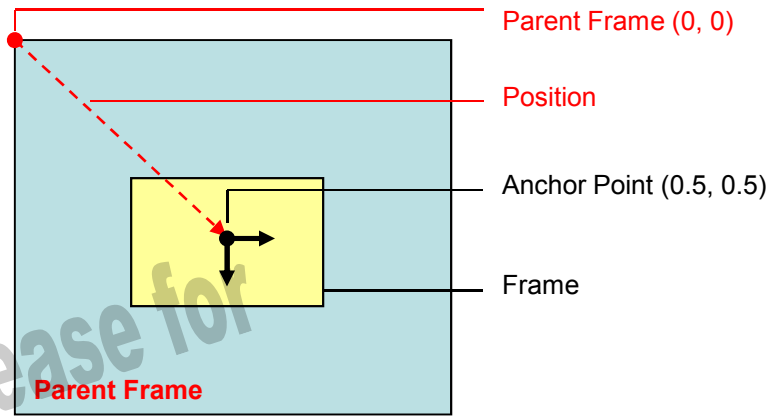
bounds.orign = (0, 70)
bounds.size = (100, 70)

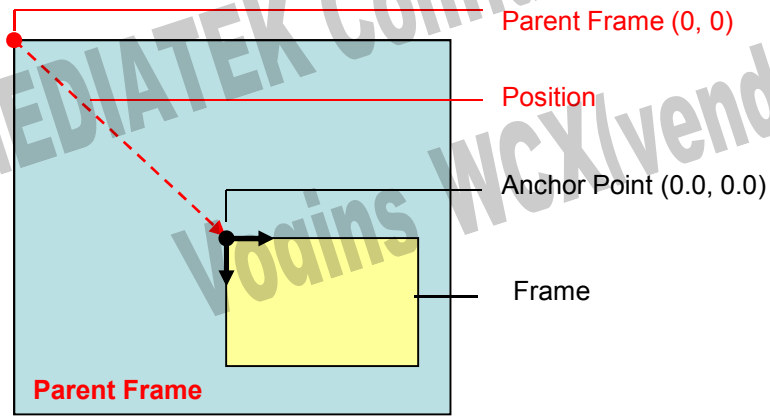
MEDIATEK Confidential Release for
Yoqins WCX(vendor)

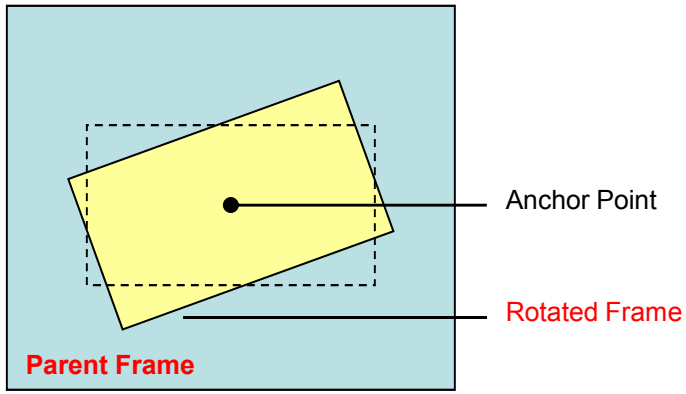
MEDIATEK Confidential Release for Vodins WCX(vendor)

Frame Anchor Point









MEDIATEK Confidential Release for Vodins WCX(vendor)

Frame-Tree Hierarchy Methods

- **getParentFrame**()
- **addChildFrame**(frame)
- **removeFromParentFrame**()
- **insertChildFrameAfter**(child_frame, new_frame)
- **insertChildFrameBefore**(child_frame, new_frame)
- **replaceChildFrameWith**(old_frame, new_frame)

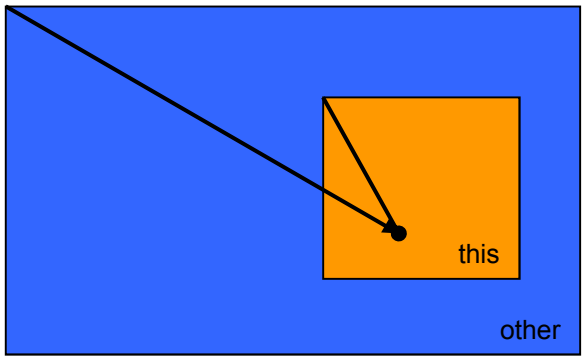
- When you assign new parent to a frame, the frame will also remove from old parent.

MEDIATEK Confidential Release for Voqins WCX(vendor)

Coordinate Convert Methods

- **convertPointFrom**(point, other)
- **convertPointTo**(point, other)
- **convertRectFrom**(rect, other)
- **convertRectTo**(rect, other)

- "this" and "other" frames must share a common parent frame.



MEDIATEK Confidential Release for Vogins WCX(vendor)

Frame Content

- Draw contexts:
  - Subclass VfxFrame and overwride the virtual function onDraw()
  - Commands of draw context is in frame coordination
    - ex. fillRect(), drawText(), …
  - (The detail in SAP VfxDrawConext class)
  - Example:
    -
```
void VfxMyPanel::onDraw(VfxDrawContext &dc)
{
    dc.drawText(0, 0, VFX_WSTR("Hello World!"));
}
```

- Image Content:
  - (See *Frame Image Content*)

MEDIATEK Confidential Release for Vogins WCX(vendor)
MEDIATEK Confidential Release for Vogins WCX(vendor)

Invalidate the Frame Content

- When the frame state has been changed and the frame content is invalidate, use invalidate() to ask renderer to redraw frame content:
  - The *onDraw()* will be called again
- UI engine force invalidates the frame content in some case
  - Modify the parent frame
- Do not assume *onDraw() will* only be called after *invalidate()*

MEDIATEK Confidential Release for Vogins WCX(vendor)

Frame Image Content

- Assign an image to be the frame content
- If you assigned a image content, VfxFrame::onDraw() will NOT be called

- Example:
  -
```
setImgContent(VfxImageSrc(IMG_ID_ICON));
setContentPlacement(
        VFX_FRAME_CONTENT_PLACEMENT_TYPE_RESIZE);
```

MEDIATEK Confidential Release for Vodins WCX(vendor)

MEDIATEK Confidential Release for Yoqins WCX(vendor)

Frame Content Placement Types

Center (default)

Resize

Resize Aspect

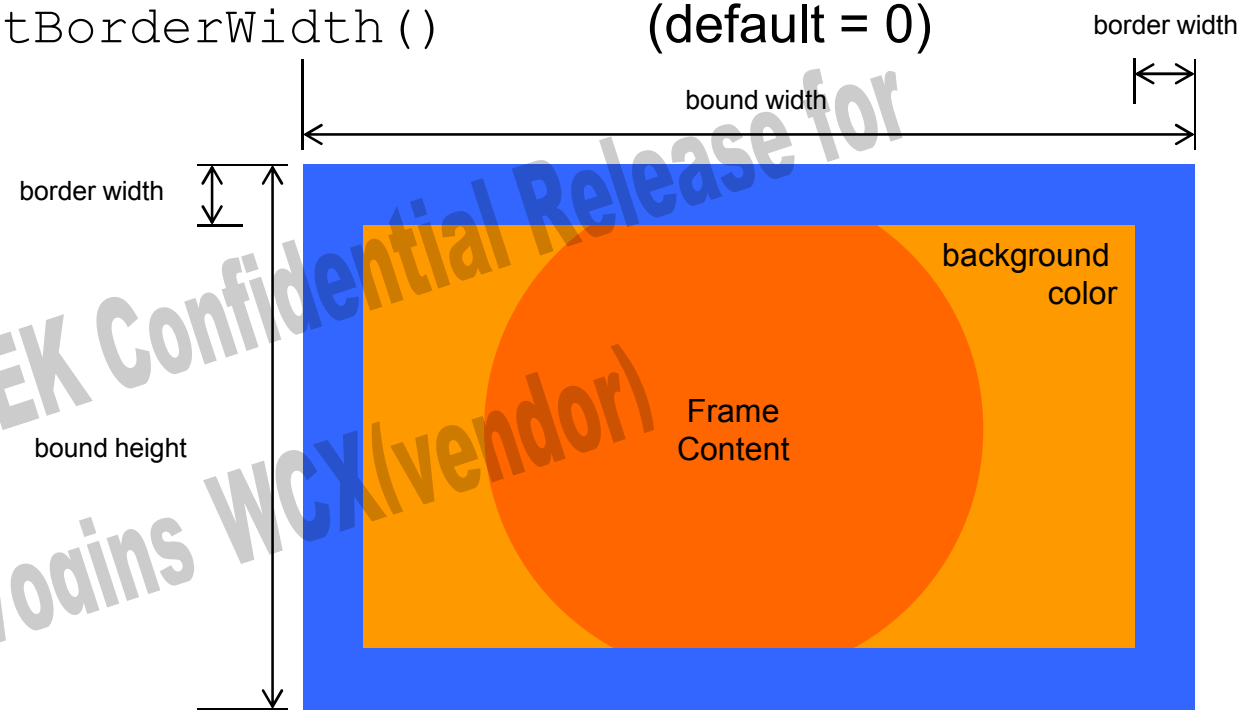
Resize Aspect Fill

MEDIATEK Confidential Release for Yoqins WCX(vendor)

MEDIATEK Confidential Release for Vodins WCX(vendor)

Frame Styles Properties

- Properties:
  - `setBgColor()` (default = transparent)
  - `setBorderColor()` (default = transparent)
  - `setBorderWidth()` (default = 0)



MEDIATEK Confidential Release for Vodins WCX(vendor)

MEDIATEK Confidential Release for Vodins WCX(vendor)

Hit Testing

- Properties:
  - setIsUnhitable() (default = VFX_FALSE)
    - *containPoint()* will always return VFX_FALSE
- Methods:
  - `VfxFrame *hitTest(point)`
    - Returns the frame in the frame that is at the specified position, include this frame
  - `VfxBool containPoint(point)`
    - Test if the frame contains a given point
  - `VfxBool onContainPoint(point)`
    - To override the behavior of **`hitTest() and containPoint()`**
    - Default implement is:
      - `return getBounds().contains(point);`
- All the point is in the coordinate of this frame

MEDIATEK Confidential Release for Vodins WCX(vendor)

Helper Methods

- getSize / setSize() :
  - Get / Set frame bounds size
- getRect / setRect() :
  - Get / Set frame position and bounds size
- setBorder() :
  - Set frame border color and width

MEDIATEK Confidential Release for Vogins WCX(vendor)

VfxImageFrame

- Create a frame with image content. Inherited from VfxFrame.
- Features:
  - Auto resized
- Properties
  - setPath()
  - setResId()

MEDIATEK Confidential Release for Vogins WCX(vendor)

MEDIATEK Confidential Release for Vogins WCX(vendor)

VfxTextFrame

- Inherited from VfxFrame
- Features:
  - Align to Natural, Left, Right and Center
  - R2L
  - Truncated
  - Auto resized:
    - Resize frame bounds size
    - Only resize height in truncated mode
- Properties
  - setString()
  - setFont()
  - setColor()
  - setBorderColor()
  - setAlignMode()
  - setTruncateMode()
  - setAutoResized()

MEDIATEK Confidential Release for Vogins WCX(vendor)

MEDIATEK Confidential Release for Vogins WCX(vendor)

Confidential B

MVC Engine: Animation

MEDIATEK Confidential Release for Vogins WCX(vendor)

Copyright © MediaTek Inc. All rights reserved.

MEDIATEK Confidential Release for Voqins WCX(vendor)

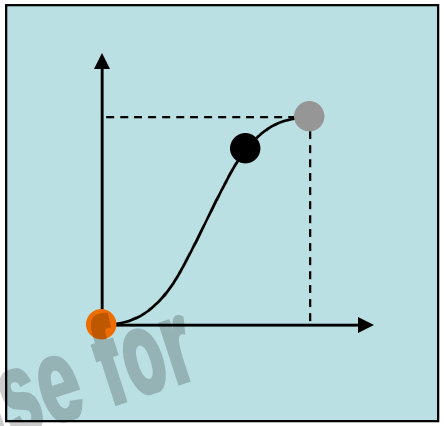
Animation Concept

- Programmer only need to set the target and duration time
- Animation Engine will automatically interpolate the transition frames

MEDIATEK Confidential Release for Voqins WCX(vendor)

MEDIATEK Confidential Release for Voolins WCX(vendor)

Animation Methods



Current value:
Value is interpolated by time

Position X Timeline

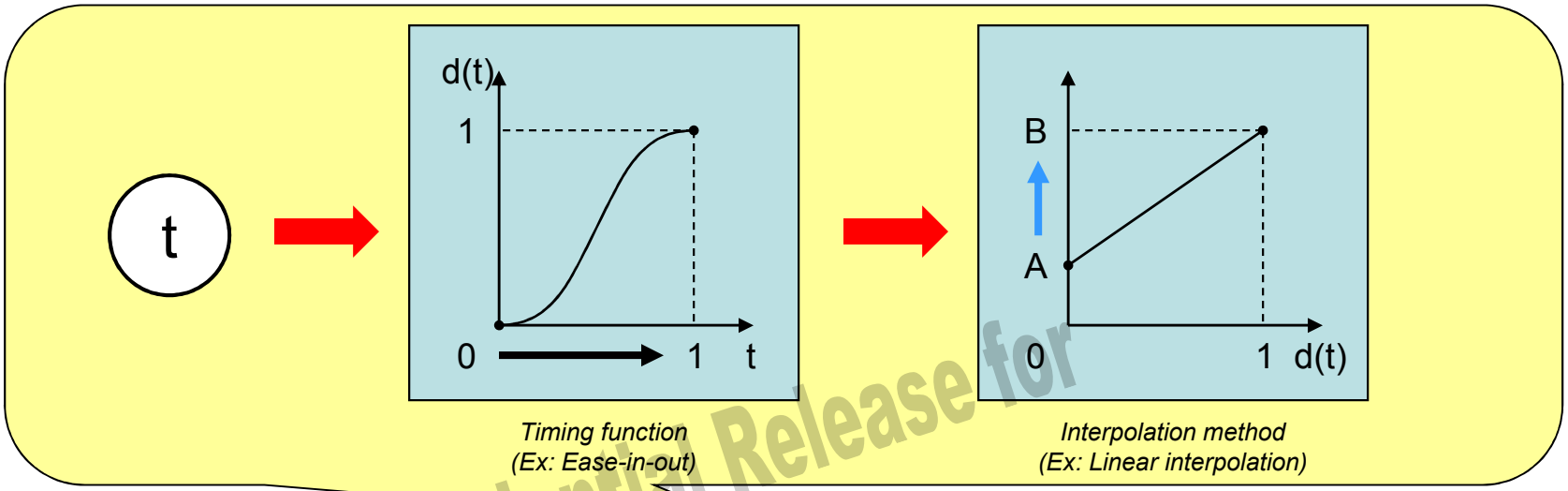
From:
Current value or
Given value

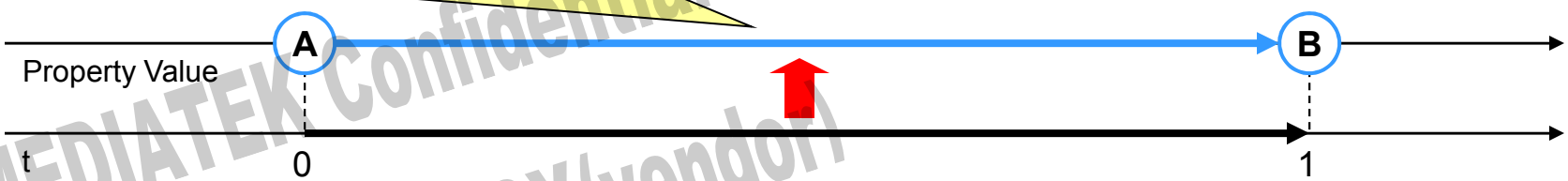
To:
Given value
At time

'From' value can use current value to handle animation interrupt.

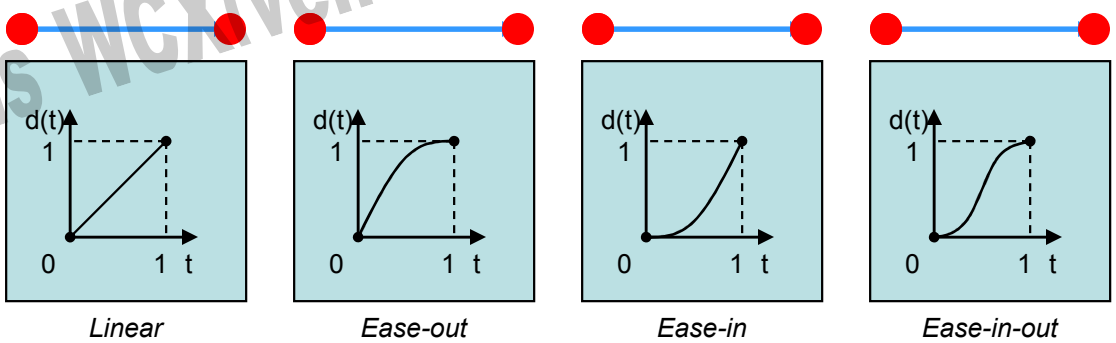
MEDIATEK Confidential Release for Vodins WCX(vendor)

Timeline Interpolation



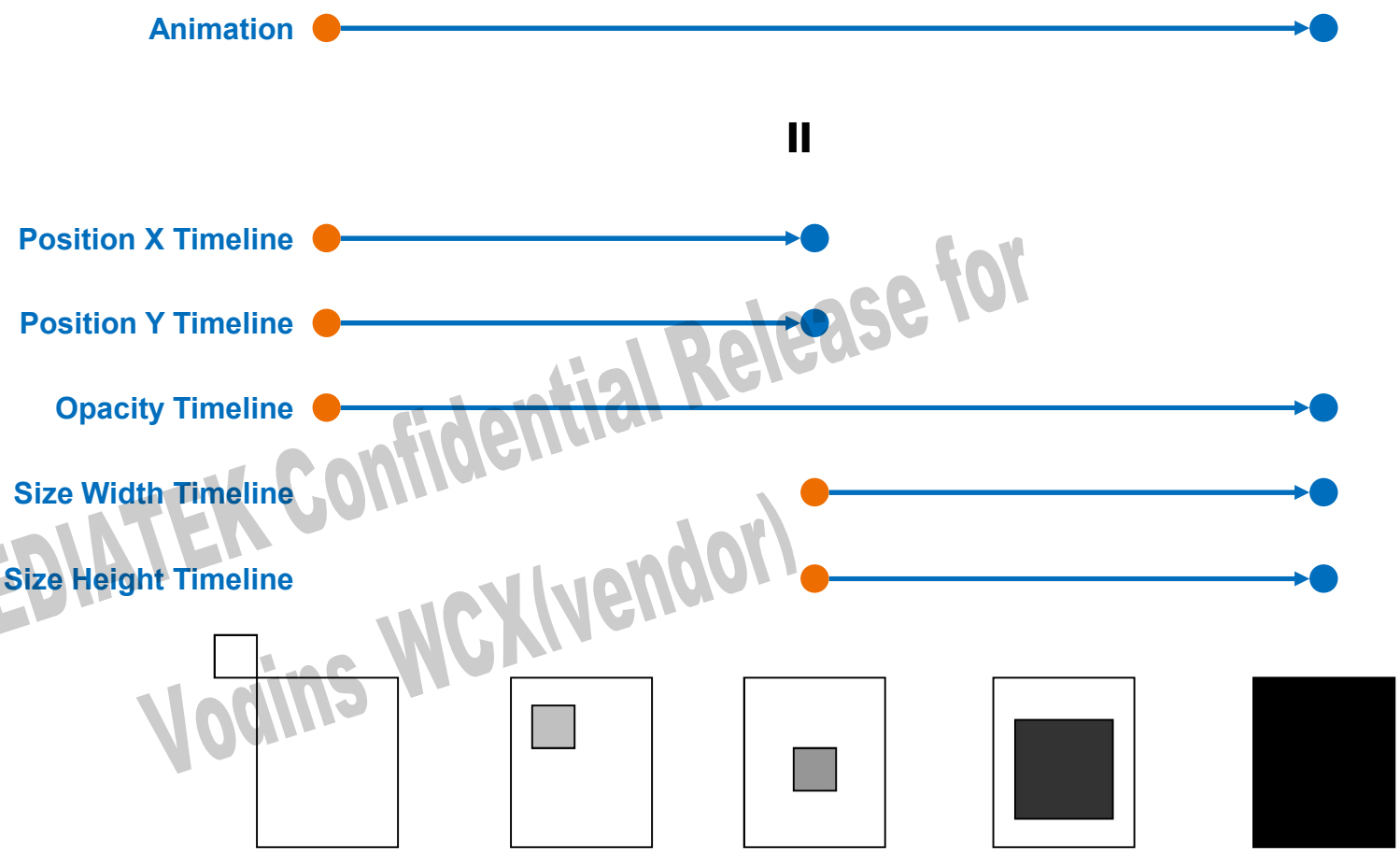


Timing functions:



MEDIATEK Confidential Release for Vodins WCX(vendor)

Complex Animation Example



MEDIATEK Confidential Release for Vodins WCX(vendor)

VfxXxxTimeline

- Timeline classes:
  - VfxFloatTimeline, VfxS32Timeline, VfxColorTimeline
  - VfxPointTimeline, VfxSizeTimeline, VfxRectTimeline
  - VfxTransformTimeline
- Properties:
  - (The detail in SAP VfxXxxTimeline class)
- Methods:
  - Start()
  - Stop()
- Signals:
  - m_signalStarted
  - m_signalStopped
- Remarks (after 09B):
  - A timelines is a mask for only visualization.
  - The frame's property value will not be changed when a timeline is started.
  - The frame's property will be reset when a timeline is closed.

MEDIATEK Confidential Release for Vendor WCX(vendor)

Example: Animation and Timeline

```
void VfxTestScreen::onInit()
{
    …

    // Create a test button
    VFX_OBJ_CREATE(m_controlButton, VfxTestButton, this);
    m_controlButton->setPos(10, 300);
    m_controlButton->setSize(100, 40);
    m_controlButton->setLabel(VFX_WSTR("Button"));

    VfxFloatTimeline *timeline;
    VFX_OBJ_CREATE(timeline, VfxFloatTimeline, this);
    timeline->setTarget(m_controlButton);
    timeline->setTargetPropertyId(VRT_FRAME_PROPERTY_ID_OPACITY);
    timeline->setFromValue(1.0f);
    timeline->setToValue(0.0f);
    timeline->setDurationTime(500);
    timeline->setRepeatCount(VFX_TIMELINE_REPEAT_INFINITE);
    timeline->setAutoReversed(VFX_TRUE);
    timeline->start();

    …
}
```

Button

MEDIATEK Confidential Release for Vodins WCX(vendor)

Auto Animation

- Use `setAutoAnimate()` to switch the auto-animation, default duration time is 250 ms
  - Default is VF_FALSE

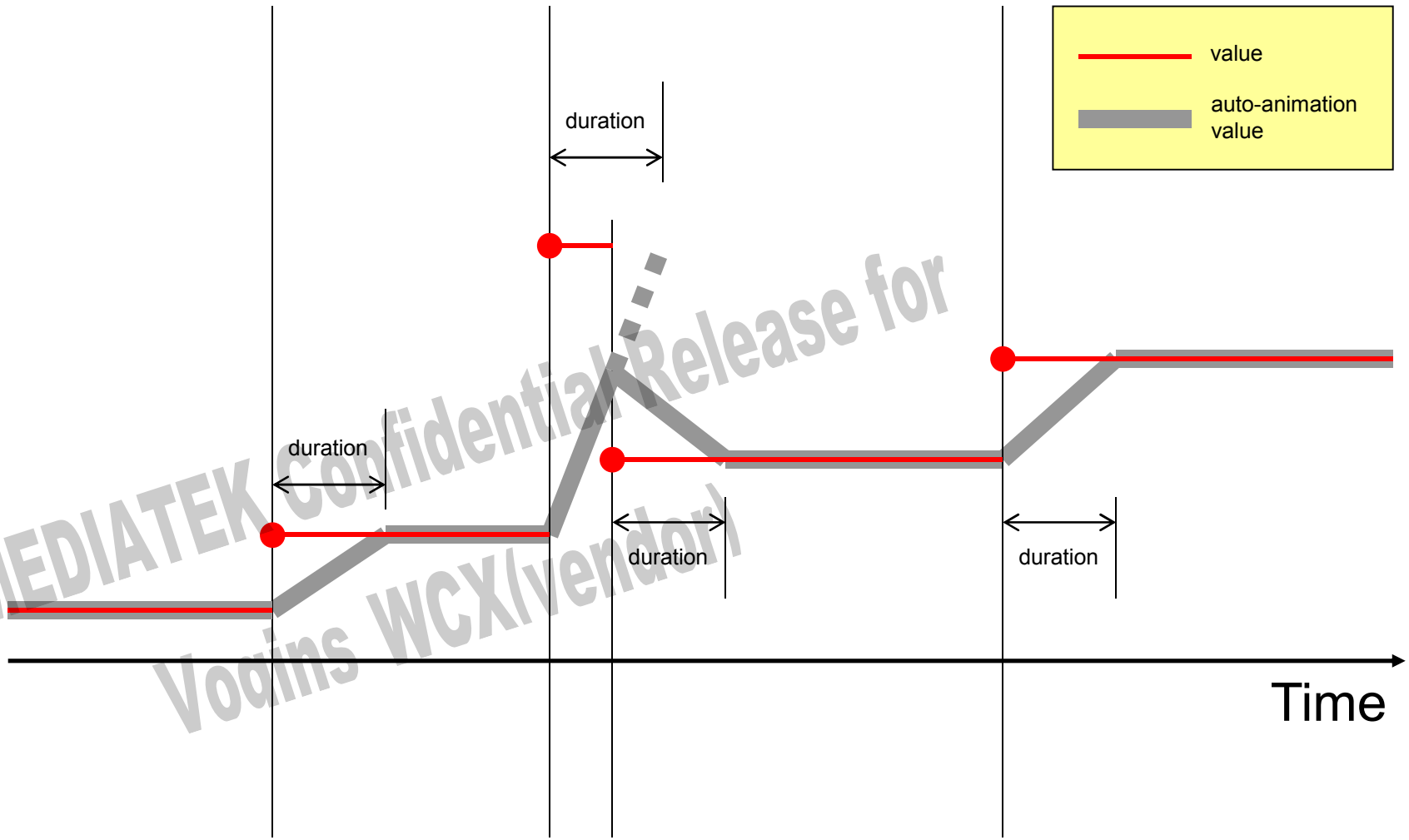
- Example Code:

```
m_controlRect->setAutoAnimate(VF_TRUE);

…

m_controlRect->setPos(120, 300);
m_controlRect->setSize(100, 100);
m_controlRect->setBgColor(VF_COLOR_RED);
```

MEDIATEK Confidential Release for Vogins WCX(vendor)

MEDIATEK Confidential Release for Vodins WCX(vendor)

Auto-Animation Property Value States



MEDIATEK Confidential Release for Vodins WCX(vendor)

Example

MEDIATEK Confidential Release for Vogins WCX(vendor)

MEDIATEK Confidential Release for Vogins WCX(vendor)

Confidential B

MVC Engine: Control and Input

MEDIATEK Confidential Release for Vogins WCX(vendor)

Copyright © MediaTek Inc. All rights reserved.

VfxControl

- *VfxControl* is a base class for Venus UI components, inherit from *VfxFrame*.
- Features:
  - All input behavior is defined in *VfxControl*
- Virtual Functions:
  - onKeyInput()
  - onPenInput()

MEDIATEK Confidential Release for Vogins WCX(vendor)

Pen Input Event

- Pen events are generated by PlutoMMI
- To handle the pen input, override the virtual function *onPenInput()* to handle pen input events.
- Routing Rule:
  - Use `VfxFrame::hitTest()` to find the target control
  - The target control will capture **all** pen events. All pen event will firstly ask the target control to handle.
  - Return VFX_TRUE if the event has been handled, or it will ask parent control step by step.
- Remark:
  - Return VFX_TRUE if the event has been handled.
  - Call *onPenInput() of* super class if the event has not been handled.

MEDIATEK Confidential Release for Vogins WCX(vendor)

VfxPenEvent

- Overridable:
  - VfxBool VfxControl::onPenInput(**VfxPenEvent** &event);
- Member Data:
  - VfxPenEventTypeEnum type;
  - VfxMsec timeStamp;
  - VfxMsec prevTimeStamp;
  - VfxMsec downTimeStamp;
  - VfxPoint pos;
  - VfxPoint prevPos;
  - VfxPoint downPos;

VFX_PEN_EVENT_TYPE_DOWN
VFX_PEN_EVENT_TYPE_UP,
VFX_PEN_EVENT_TYPE_MOVE,
VFX_PEN_EVENT_TYPE_ABORT,
...

- Methods:
  - VfxPoint getRelPos(VfxControl *relTo) const;
  - VfxPoint getRelDownPos(VfxControl *relTo) const;
  - VfxPoint getRelPrevPos(VfxControl *relTo) const;

MEDIATEK Confidential Release for Vendors WCX(vendor)

MEDIATEK Confidential Release for Vogins WCX(vendor)

Keypad Input Event

- Access Key:
  - Use `VfxKeypad::registerHandler()` to register keys
  - The register table is a stack:
    - Each key can be registered with many controls
    - Only the latest registered control will got the key input event
- Override virtual function *onKeyInput()* to handle keypad input events
  - Return VFX_TRUE if you handled the event, or the event will resend to next control

MEDIATEK Confidential Release for Vogins WCX(vendor)

MEDIATEK Confidential Release for Vogins WCX(vendor)

VfxKeyEvent

- VfxBool VfxControl::onKeyInput(**VfxKeyEvent** &event);
- Member Data:
  - VfxKeyEventTypeEnum type;
  - VfxKeyCodeEnum keyCode;

VFX_KEY_EVENT_TYPE_DOWN,
VFX_KEY_EVENT_TYPE_UP,
...

MEDIATEK Confidential Release for Vogins WCX(vendor)

MEDIATEK Confidential Release for Vogins WCX(vendor)

Confidential B

MVC Engine: Timer

MEDIATEK Confidential Release for Vogins WCX(vendor)

Copyright © MediaTek Inc. All rights reserved.

Venus Timer

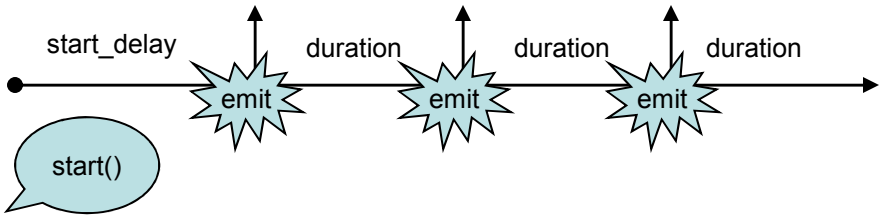
- Just like other time, Venus timer always callback after the time expired.
- The time in one call stack is unique:
  - ex. These two timer will be started at same time
    -
```
void MyClass::doSomething()
{
    m_timer1->setStartDelay(500);
    m_timer1->start();
    …
    m_timer2->setStartDelay(500);
    m_timer2->start();
}
```
- Venus Timer may callback very lately on backlight is off (not more than 30 sec.)
  - For power saving
- Start delay time 0 means the time after commit.

MEDIATEK Confidential Release for Vocins WCX(vendor)

MEDIATEK Confidential Release for Vogins WCX(vendor)

VfxTimer

- VfxTimer is a class to operate the system timer, an event will be emitted after you start the timer with a given time. Sometimes can use timer to make animations
- Features:
  - **Interval timer**
    - If property d*uration* is not zero, the timer will be emitted every d*uration* time after s*tartDelay* time
- Properties:
  - *setStartDelay()*
  - *setDuration()*
- Methods:
  - *start()*
    - Alloc a system timer and start it
  - *stop()*
    - Stop the system timer and free it
  - *getIsEnabled()*
    - Return if the timer is started
- Event:
  - m_SignalTick



Example: Timer

```
void VfxTestObj::onInit()
{
    // Create an timer
    VFX_OBJ_CREATE(m_timer, VfxTimer, this);
    m_timer->setStartDelay(500)
    m_timer->setDuration(1000)
    m_timer->m_signalTick.connect(this, &VfxTestObj::onTimerTick);
    m_timer->start();
}


void VfxTestObj::onTimerTick(VfxTimer *source)
{
    m_tickCount++;
}
```

MEDIATEK Confidential Release for Vogins WCX(vendor)

MEDIATEK Confidential Release for Vogins WCX(vendor)

MEDIATEK Confidential Release for Voqins WCX(vendor)

Confidential B

MEDIATEK

Q & A

MEDIATEK Confidential Release for Voqins WCX(vendor)

Copyright © MediaTek Inc. All rights reserved.

MEDIATEK Confidential Release for Voqins WCX(vendor)

Confidential B

Appendix

MEDIATEK Confidential Release for Voqins WCX(vendor)

Copyright © MediaTek Inc. All rights reserved.

Folder Structure

- mcu\
  - venusmmi\
    - vrt\
      - Interface\ (VRT external header files)
    - framework\
      - interface\ (Framework external header files)
      - ui_core\
        - base\ (System, data type, basic type classes, …)
        - pme\ (PME classes)
        - mvc\ (MVC classes)
    - visual\
      - interface\ (Visual components external header files)
      - cp\ (UI components)
    - app\
      - HomeScreen\ (All HomeScreen and Widgets)
      - Mainmenu\
    - service\
      - Interface\
      - data\ (Data engine encapsulated as PME C++ object)
    - pluto_adapter\ (Adapters to PlutoMMI)
      - interface\
    - test\ (Some test codes)

MEDIATEK Confidential Release for Vodins WCX(vendor)

Include Path & Export header files

- mcu\
  - venusmmi\
    - vrt\
      - Interface\ vrt_include.h
    - framework\
      - interface\ vfx_uc_include.h
    - visual\
      - interface\ vcp_include.h
    - service\
      - interface\ vdat_include.h
    - pluto_adapter\
      - interface\ vadp_*.h

*APP does not need to include VRT directly

MEDIATEK Confidential Release for Vodins WCX(vendor)

File Name Prefix

- mcu\
  - venusmmi\
    - vrt\ ➔ vrt_*
    - framework\ ➔ vfx_*
    - visual\ ➔ vcp_*
    - app\ ➔ vapp_*
      - HomeScreen\ ➔ vapp_hs_*
      - Mainmenu\ ➔ vapp_mm_*
    - service\ ➔ vdat_*
    - pluto_adapter\ ➔ vadp_*
    - test\ ➔ vtst_*

Ex: vadp_v2p_hs_ .c	(Venus HomeScreen use Pluto)
Ex: vadp_p2v_hs_ .CPP	(Pluto use Venus HomeScreen)
Ex: vadp_v2p_frm_ .c	(Venus Framework use Pluto)
Ex: vadp_p2v_frm_ .CPP	(Pluto use Venus Framework)

MEDIATEK Confidential Release for Vodins WCX(vendor)

Class / Type / Function Name Prefix

- mcu\
  - venusmmi\
    - vrt\ ➔ vrt_*
    - framework\ ➔ Vfx*
    - visual\ ➔ Vcp*
    - app\ ➔ Vapp*
      - HomeScreen\ ➔ VappHS*
      - Mainmenu\ ➔ VappMm*
    - service\ ➔ Vdat*
    - pluto_adapter\ ➔ Vadp*
    - test\ ➔ Vtst*

MEDIATEK Confidential Release for Vodins WCX(vendor)

MEDIATEK Confidential Release for Voqins WCX(vendor)

Confidential B

MEDIATEK

Classes, Propertis and Methods

MEDIATEK Confidential Release for Voqins WCX(vendor)

Copyright © MediaTek Inc. All rights reserved.

MEDIATEK Confidential Release for Voqins WCX(vendor)

Rendering Optimization Hints

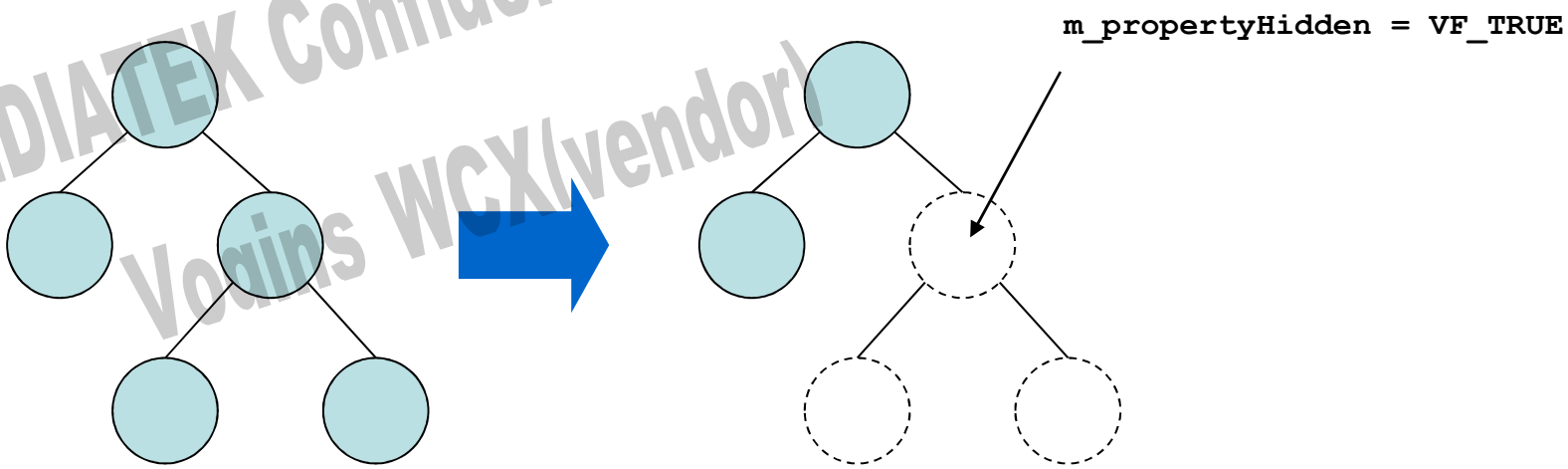
- Properties:
  - `setHidden()`
  - `setIsOpaque()`
  - `setIsCached()`
  - `setQuality()`

MEDIATEK Confidential Release for Voqins WCX(vendor)

MEDIATEK Confidential Release for Voqins WCX(vendor)

VfxFrame Hint: Hidden

- When you need to hide a frame without animation
- Hit testing ignores all hidden frames
- Todo:
  - `setHidden(VF_TRUE)`
  - default = VF_FALSE
- Pro:
  - reduce the scene graph in the renderer



VfxFrame Hint: IsOpaque

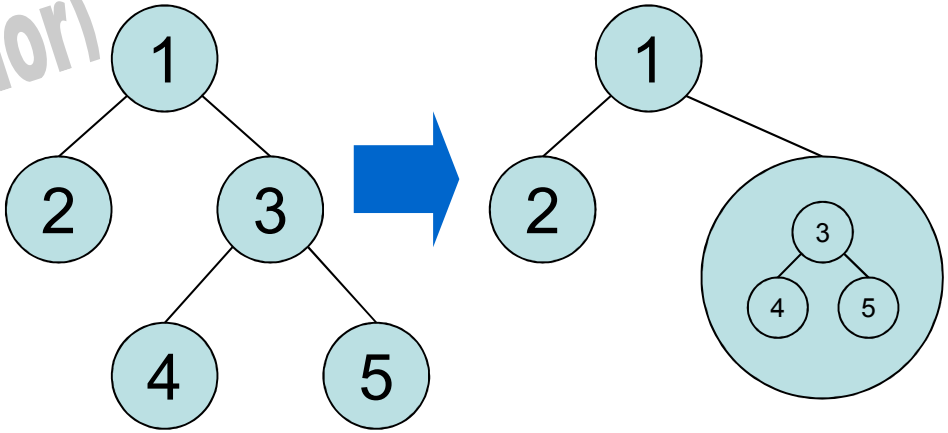
- When a frame no need opacity (opacity always 1.0)
  - Ex: desktop image
- Todo:
  - `setIsOpaque(VF_TRUE)`
  - default = VF_FALSE
- Pro:
  - Less memory usage
  - Higher frame rate

MEDIATEK Confidential Release for Vogins WCX(vendor)

MEDIATEK Confidential Release for Vodafone WCX(vendor)

VfxFrame Hint: IsCached

- When a frame and its child frames are very complex, and seldom changed
- Todo:
  - `setIsCached(VF_TRUE)`
  - default = VF_FALSE
- Pro:
  - Higher frame rate
- Cons:
  - Higher memory usage



VfxFrame Hint: Quality

- When a frame has transform (scale, rotate, …), and the render quality is not impotent
- Todo:
  - `setQuality(VFX_RENDER_QUALITY_NORMAL)`
  - default = 0 (auto)
- Pro:
  - Higher frame rate
- Cons:
  - Bad transform quality

MEDIATEK Confidential Release for Vodins WCX(vendor)

VfxAnimation

- *VfxAnimation* is a collection of timelines
- Methods:
  - addTimeline(VfxBaseTimeline *)
    - Add a timeline into the animation
  - removeTimeline(VfxBaseTimeline *)
    - Add a timeline into the animation
  - start()
    - Start all timelines in the animation
  - stop()
    - Stop all timelines in the animation

MEDIATEK Confidential Release for Vogins WCX(vendor)

MEDIATEK Confidential Release for Voqins WCX(vendor)

Confidential B

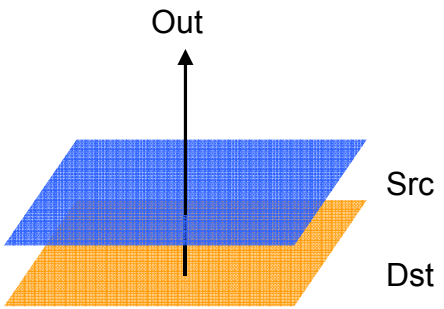
Other Topics

MEDIATEK Confidential Release for Voqins WCX(vendor)

Copyright © MediaTek Inc. All rights reserved.

Pre-multiplied Alpha Color Format

- Alpha Blending Formula:
  - Source over Destination Mode
  - `Rout = Asrc * Rsrc + (1 - Asrc) * Rdst`
  - `Gout = Asrc * Gsrc + (1 - Asrc) * Gdst`
  - `Bout = Asrc * Bsrc + (1 - Asrc) * Bdst`
- Pre-multiplied Color Format:
  - `R' = (A * R)`
  - `G' = (A * G)`
  - `B' = (A * B)`
  - `A`
- Alpha Compositing:
  - `R'out = R'src + (1 - Asrc) * R'dst`
  - `G'out = G'src + (1 - Asrc) * G'dst`
  - `B'out = B'src + (1 - Asrc) * B'dst`
  - `Aout  = Asrc  + (1 - Asrc) * Adst`



MEDIATEK Confidential Release for Vogins WCX(vendor)