Clock tutorial

Summary

See the object tutorial for more info about basic object creation.

Here we register the processing callback on two different clocks for didactic purposes only. Of course, all objects can be updated from the same clock. [1)]

The first clock runs at 100 Hz and the second one at 5 Hz.

If you press the arrow keys up, down and right, you can alter the time stretching of the first clock. It'll still be updated at the same rate, but the time information that the clock will pass to the callback will be stretched.

This provides an easy way for adding time distortion and having parts of your logic code updated at different frequencies. One clock can have as many registered callbacks as you want, with an optional context parameter.

For example, the FPS displayed in the top left corner is calculated with a non-stretched clock that runs at 1Hz.

Details

When using orx, we don't have to write a global

```
while(1){}
```

loop to update our logic. Instead we create a clock [2)], specifying its update frequency.

As we can create as many clocks as we want, we can make sure that the most important part of our logic (player, NPCs, ...) will be updated very often, whereas low priority code will be called once in a while (non-interactive/background objects, etc...).

There is also another big advantage in using separate clocks: we can easily achieve time stretching.

In this tutorial, we create two clocks, one that runs at 100Hz (period=0.01s) and the other at 5Hz (period=0.2s).

```
orxCLOCK *pstClock1, *pstClock2;

pstClock1 = orxClock_CreateFromConfig("Clock1");

pstClock2 = orxClock_CreateFromConfig("Clock2");
```

And in config we simply have:

```
[Clock1]
Frequency = 100

[Clock2]
Frequency = 5
```

*NB: By default the core clock will use a maximized DT (cf. orx's render module settings) which means that the core clock and user created clocks, even based on the same frequency, might get out of sync due to extreme lag [3]. If you want to keep all your user-created clocks in sync with the core one, you can either ask for no maximized DT for the core clock in the render module config section **or** set the same maximized DT on your user clock with the orxClock_SetModifier() function.*

Now we'll use the same update callback on both clocks. However, we'll give them different context so that the first clock callback registration applies to our first object, and the second one on the other object:

```
orxClock_Register(pstClock1, Update, pstObject1, orxMODULE_ID_MAIN,
orxCLOCK_PRIORITY_NORMAL);

orxClock_Register(pstClock2, Update, pstObject2, orxMODULE_ID_MAIN,
orxCLOCK_PRIORITY_NORMAL);
```

This means our callback will be called 100 times per second with pstObject1 and 5 times per second with pstObject2.

As our update callback just rotates the object it gets from the context parameter, we'll have, as a result, both objects turning as the same speed. However, the rotation of the second one will be far less smooth (5 Hz) than the first one's (100 Hz).

Now let's have a look at the callback code itself.

First thing: we need to get our object from the extra context parameters.
As orx is using OOP in C, we need to cast it using a cast helper that will check for cast validity.

```
pstObject = orxOBJECT(_pstContext);
```

If this returns `NULL`, either the parameter is incorrect, or it isn't an `orxOBJECT`.

Our next step will be to apply the rotation to the object.

```
orxObject_SetRotation(pstObject, orxMATH_KF_PI * _pstClockInfo->fTime)
```

We see here that we use the time taken from our clock's information structure.
That's because all our logic code is wrapped in clocks' updates that we can enforce time consistency and allow time stretching.

Of course, there are far better ways of making an object rotate on itself [4].
But let's back to our current matter: clock and time stretching!

As you have probably noticed in the source code, we were also looking for the main clock and we registered our UpdateInput callback to it. There's a very good reason for that: we don't want to handle

inputs in a user created callback as the input module will get updated from the main clock and can possibly get out of sync of user callbacks [5].
As a rule of thumb it's better to always handle inputs in callbacks registered to the main clock or via events sent from the input module [6].

Inputs are merely character strings that are bound, either in config file or by code at runtime, to key presses, mouse buttons or even joystick buttons.

In our case, if the up or down arrow keys are pressed, we'll strecthed the time for the first clock that has been created.
If left or right arrow keys are pressed, we'll remove the stretching and go back to the original frequency.

As we didn't store our first created clock [7], we need to get it back!

```
pstClock = orxClock_Get("Clock1");
```

Specifying `-1.0f` as desired period means we're not looking for a precise period but for all clocks of the specified type. It'll return the first clock created with the `orxCLOCK_TYPE_USER` type, which is the one updating our first object.

Now, if the "`Faster`" input is active(ie. up arrow key is pressed), we'll speed our clock with a factor 4X.

```
if(orxInput_IsActive("Faster"))
{
  /* Makes this clock go four time faster */
  orxClock_SetModifier(pstClock, orxCLOCK_MOD_TYPE_MULTIPLY, orx2F(4.0f));
}
```

In the same way we make it 4X slower than originally by changing its modifier when "`Slower`" input is active (ie. down arrow pressed).

```
else if(orxInput_IsActive("Slower"))
{
  /* Makes this clock go four time slower */
  orxClock_SetModifier(pstClock, orxCLOCK_MOD_TYPE_MULTIPLY, orx2F(0.25f));
}
```

Lastly, we want to set it back to normal, when the "`Normal`" input is active (ie. left or right arrow key pressed).

```
else if(orxInput_IsActive("Normal"))
{
  /* Removes modifier from this clock */
  orxClock_SetModifier(pstClock, orxCLOCK_MOD_TYPE_NONE, orxFLOAT_0);
}
```

And here we are! 
As you can see, time stretching is achieved with a single line of code. As our logic code to rotate our

object will use the clock's modified time, we'll see the rotation of our first object changing based on the clock modifier value.

This can be used in the exact same way to slow down monsters while the player will still move as the same pace, for example. There are other clock modifiers type but they'll be covered later on.

Priority

When setting up clock callbacks in orx, we need to specify a priority for the callback. This priority value specifies when a callback will occur during the execution within a given frame.

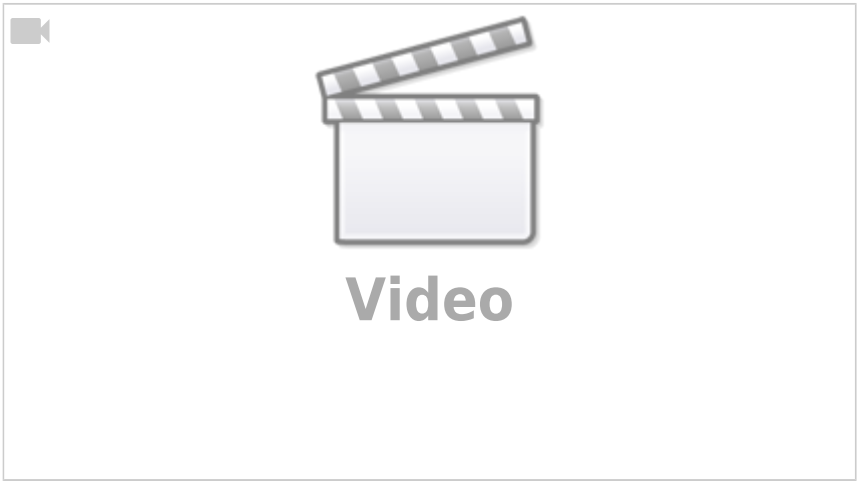
1. Render all viewports/objects & emit all the draw calls (using the state of the previous frame), let the GPU work as early as possible (priority = HIGHEST)
2. Update inputs (physical polling w/ priority = HIGHER, input module w/ priority = HIGH)
3. (Scroll only) Game Update (if no Scroll, that's where one should likely put their logic as well, ie. priority = NORMAL)
4. Update all objects and linked structures (anim, sound, FX, etc., priority = LOW)
5. Update the physics simulation (priority = LOWER)
6. End the render frame, ask for presentation (priority = LOWEST)

Resources

Source code: 02_Clock.c

Config file: 02_Clock.ini

Video by acksys:



1)

The given clock context is also used here for demonstration only.

2)

or we register to an existing one, such as the core clock

3)

when dragging the window by its title bar, for example

4)

by giving it an angular velocity for example, or even by using an `orxFX`

5)

especially if they don't have the same frequency or different attributes

6)

orxEVENT_TYPE_INPUT

7)

on purpose, so as to show how to retrieve it

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