Unity Cluster Package – Example Project Documentation

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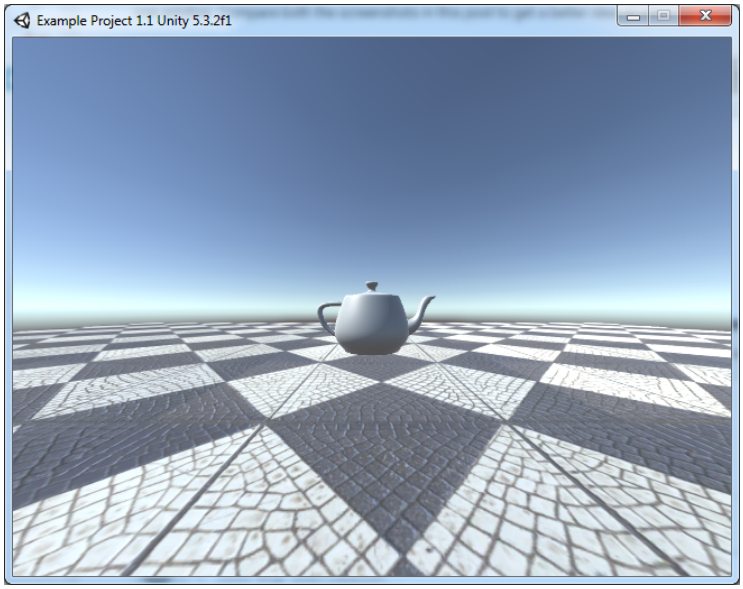
1 Introduction

This document is a brief explanation of the Example Project using the Unity Cluster Package. For more specific and scientific information please check the package main paper (1), the survey used as base (2) and/or some multiprojection applications built with this custom Unity package (3).

The Example Project consists of the classic teapot model in constant rotation over a checkered textured terrain, as shown in Figure 1. The user can navigate in the virtual environment by means of a flying camera controlled through the arrow keys on the keyboard.

Figure 1 – Example project.



The following sections present the principal points in the Example Project, in order to help developers create multriprojection applications using the Unity Cluster Package.

2 State Changes in Objects

Since Unity Cluster Package implements the Master-Slave rendering model, only the master node application performs state changes in objects. These objects must use the NetworkView component from the Unity network module for state synchronization among the slave node applications. As an example, Figure 2 shows the rotation script (TeapotRotate.cs) attached to the teapot model.

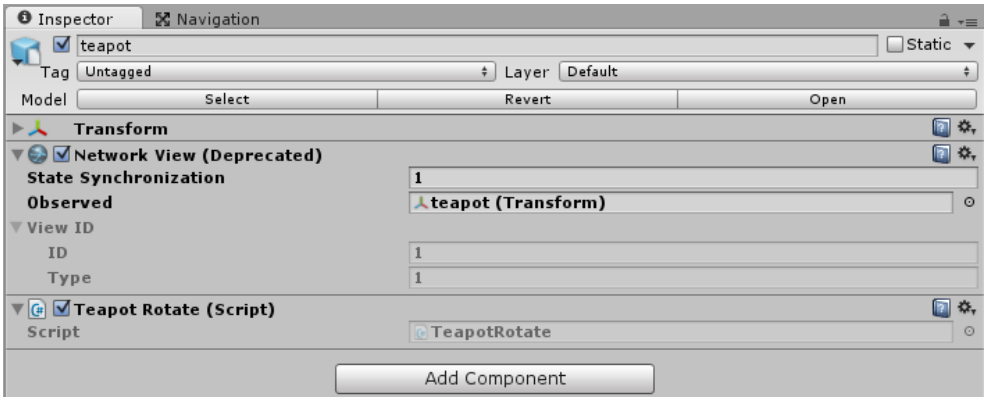
Figure 2 – TeapotRotate.cs - rotation script.

```
1  using UnityEngine;
2  using UnityClusterPackage;
3
4  public class TeapotRotate : MonoBehaviour {
5
6      // Use this for initialization
7      void Start() {
8          if ( NodeInformation.type.Equals("slave") ) {
9              enabled = false;
10         }
11     }
12
13     // Update is called once per frame
14     void Update () {
15         transform.Rotate(Vector3.up * Time.deltaTime * 30.0f);
16     }
17 }
```

Note that, if node type is “slave” the script will be set enabled false (lines 8 and 9), not performing rotations. However, when node type is “master” the script will apply the rotations (line 15). In order to synchronize the rotations performed by the master node application, the teapot model uses the NetworkView component, as shown in Figure 3.

In the same way, the flying camera script (FlyCamera.cs) is only performed by the master node application, meanwhile the *Multi Projection Camera* from the Unity Cluster Package uses the NetworkView component for synchronization purposes.

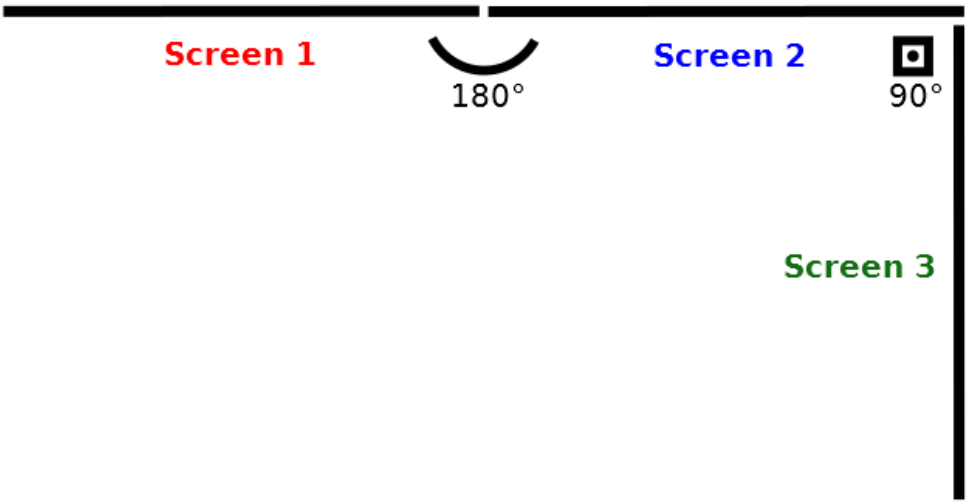
Figure 3 – Teapot NetworkView.



3 Master and Slave Applications Configuration

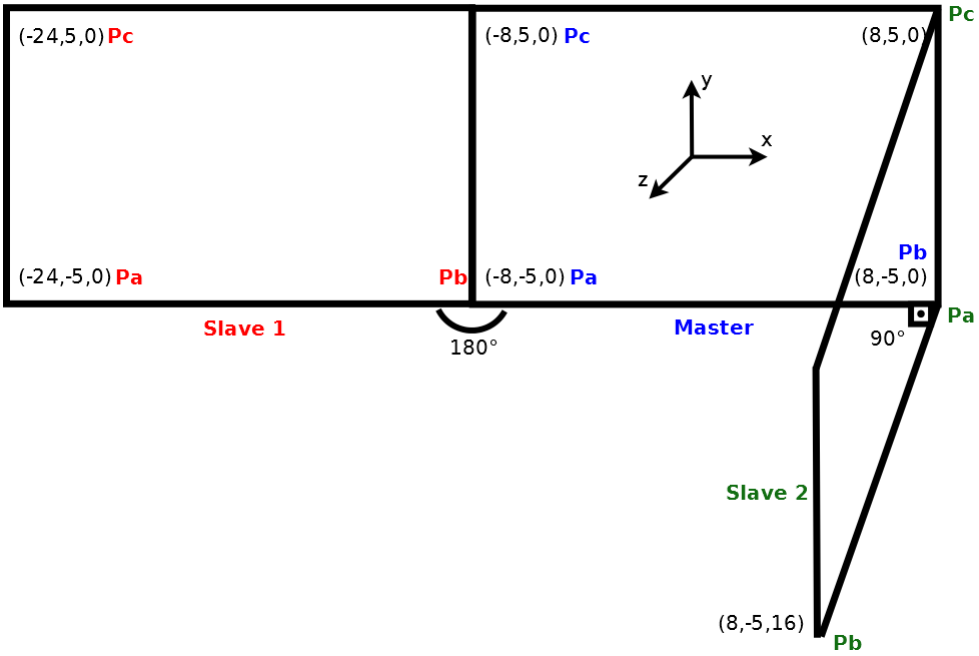
The Unity Cluster Package supports different multi-projection systems regarding the size, aspect ratio, position and orientation of the screens. Figure 4 shows the 3-screens system used as example.

Figure 4 – 3-Screens system - top view.



Applications are assigned to the screen according to the three points (Pa, Pb, and Pc) from the screen corners (Pa at the lower left, Pb at the lower right, and Pc at the upper left) in a coordinate system with the origin in the center of the front screen. Figure 5 shows the Pa, Pb and Pc points for each screen.

Figure 5 – Pa, Pb and Pc points.



The Unity Cluster Package is based on the Unity network support for the Client-Server communication model. The master node application is an Unity server. The slave node applications are Unity clients connected to the Unity server in the master node application.

Applications obtain the cluster node specification through an XML configuration file (node-config.xml) in the StreamingAssets folder. The master node application is assigned to one of the three screens as shown in Figure 5, which is not mandatory. Figures 6, 7 and 8 show the Master, Slave 1 and Slave 2 configuration files. Figure 9 shows the Master, Slave 1 and Slave 2 applications performed side by side on the same computer.

Figure 6 – Master configuration file.

```
<?xml version="1.0" encoding="UTF-8"?>
<node type="master" name="Master Node" id="0" nodes="3">
    <server ip="192.168.1.5" port="25000"/>
    <screen stereo="false" eye="">
        <pa x="-8" y="-5" z="0" />
        <pb x="8"  y="-5" z="0" />
        <pc x="-8" y="5"  z="0" />
        <pe x="0"  y="0"  z="5" />
    </screen>
</node>
```

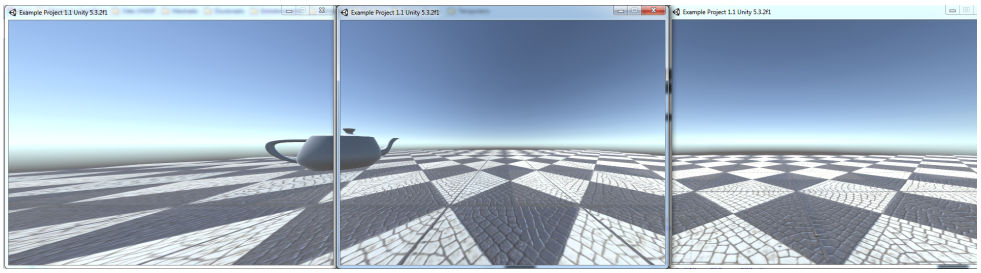
Figure 7 – Slave 1 configuration file.

```
<?xml version="1.0" encoding="UTF-8"?>
<node type="slave" name="Slave Node 1" id="1" nodes="3">
    <server ip="192.168.1.5" port="25000"/>
    <screen stereo="false" eye="">
        <pa x="-24" y="-5" z="0" />
        <pb x="-8"  y="-5" z="0" />
        <pc x="-24" y="5"  z="0" />
        <pe x="0"   y="0"  z="5" />
    </screen>
</node>
```

Figure 8 – Slave 2 configuration file.

```
<?xml version="1.0" encoding="UTF-8"?>
<node type="slave" name="Slave Node 2" id="2" nodes="3">
    <server ip="192.168.1.5" port="25000"/>
    <screen stereo="false" eye="">
        <pa x="8" y="-5" z="0" />
        <pb x="8" y="-5" z="16" />
        <pc x="8" y="5"  z="0" />
        <pe x="0" y="0"  z="5" />
    </screen>
</node>
```

Figure 9 – The Master, Slave 1 and Slave 2 applications performed side by side.



4 Mottion Paralax using the Mouse Device

The *Multi Projection Camera* from the Unity Cluster Package arranges the scene object *UserHead*. By moving this object based on a head-tracker device the motion parallax is achieve, providing a better perception in the virtual environment. The script ParallaxMouse.cs (Figure 10) moves the object *UserHead* according to the mouse device once the line 21 is not commented.

Since the *UserHead* x axis is rotated, the mouse y axis is the *UserHead* z axis. Note that, this script is only performed by the master node application and the object *UserHead* uses the NetworkView component for synchronization purposes.

Figure 10 – ParallaxMouse.cs - Mottion Paralax x Mouse Device.

```
using UnityEngine;
using UnityClusterPackage;

public class ParallaxMouse : MonoBehaviour {

    private float x, y;

    // Use this for initialization
    void Start() {
        if ( NodeInformation.type.Equals("slave") )
        {
            enabled = false;
        }
    }

    // Update is called once per frame
    void Update () {
        x = ( Input.mousePosition.x - Screen.width/2 ) * 16/Screen.width;
        y = ( Input.mousePosition.y - Screen.height/2 ) * 10/Screen.height;

        //transform.localPosition = new Vector3(x, 5, y);
    }
}
```

If you need any references or have any questions, do not hesitate to contact me by email: mariopopolin@ifsp.edu.br

References

1 POPOLIN NETO, M. et al. Computational science and its applications – iccsa 2015: 15th international conference, banff, ab, canada, june 22-25, 2015, proceedings, part v. In: _____. Cham: Springer International Publishing, 2015. cap. Unity Cluster Package – Dragging and Dropping Components for Multi-projection Virtual Reality Applications Based on PC Clusters, p. 261–272. ISBN 978-3-319-21413-9. Disponível em: <http://dx.doi.org/10.1007/978-3-319-21413-9_19>.

2 POPOLIN NETO, M.; BREGA, J. R. F. A survey of solutions for game engines in the development of immersive applications for multi-projection systems as base for a generic solution design. In: *Virtual and Augmented Reality (SVR), 2015 XVII Symposium on*. [S.l.: s.n.], 2015. p. 61–70.

3 POPOLIN NETO, M. et al. An immersive and interactive visualization system by integrating distinct platforms. In: *Information Visualisation (iV), 2015 19th International Conference on*. [S.l.: s.n.], 2015. p. 403–410. ISSN 1550-6037.