Distributed Unity Applications: Evaluation of Approaches

Approaches Virtual Scene Mutual Frustum Partial Frustum (Worker 1) Cull scene Partial Frustum (Worker 2) Visible objects Partial Frustum (Worker 3) OnWillRenderObject callback Visible objects Manager Managei Worker 3 Worker 1 Worker 3 Worker 2 Worker 3 Worker 2

Adaptive F Selective synchronization: tests objects Broadcast: all states to all instances against each frustum

Highest integrity level

instance

instances

High network overhead

Low overhead on the manager

Depends on number of virtual

objects and number of application

- Low integrity level (e.g. shadows issues)
- Low network overhead

Adaptive_C

• Selective synchronization: uses Unity

determine object's visibility for the

callback OnWillRenderObject to

• Low integrity level (e.g. shadows

High overhead on the manager

Depends on number of application

worker instances

Low network overhead

issues)

instance

instances

- High overhead on the manager instance
- Depends on number of virtual objects and number of application instances

Virtual objects are **cubes** of the same size and different color. Virtual objects rotate around Y-Axis

the same size and different

color. Virtual objects rotate

around Y-axis.

Virtual objects are **sprites** of

2D

Evaluation Scenarios

Static

Dynamic

Cameras are static, and not synchronized. All

virtual objects lay within the mutual

One directional light at random position. The light casts shadows.

One directional light at random

position. The light casts no shadows

Standard

Shadow

Multiple

Lights

One directional light and eight point <u>lights</u> at random position. <u>Neither</u> of them casts shadows.

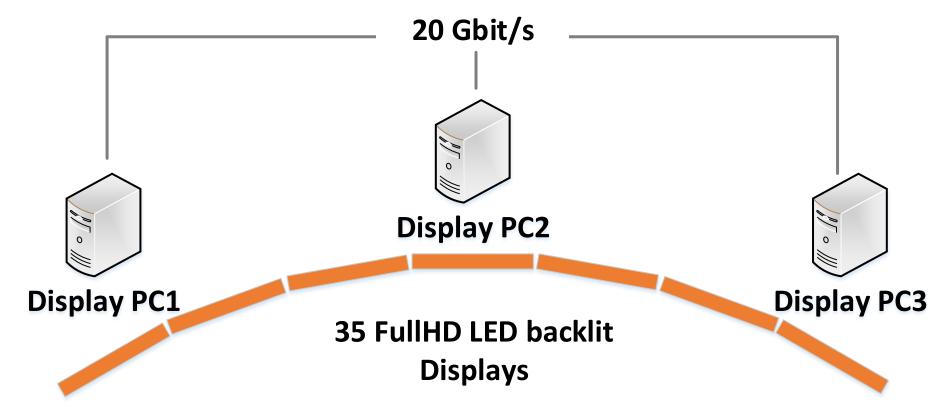
Evaluation Hardware Setup

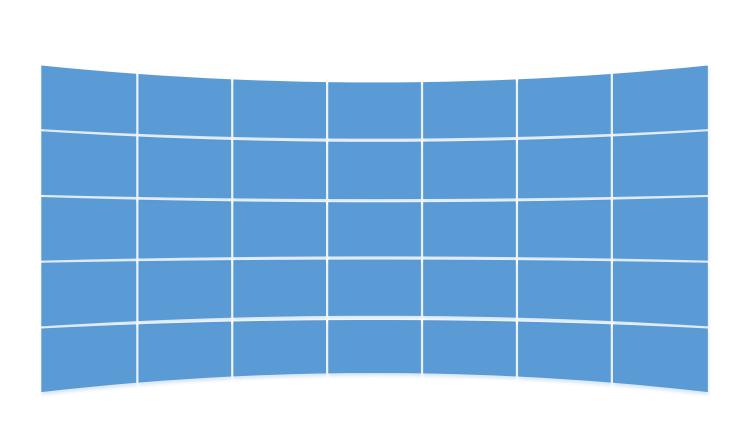
Cameras are **dynamic**, and **synchronized**. They

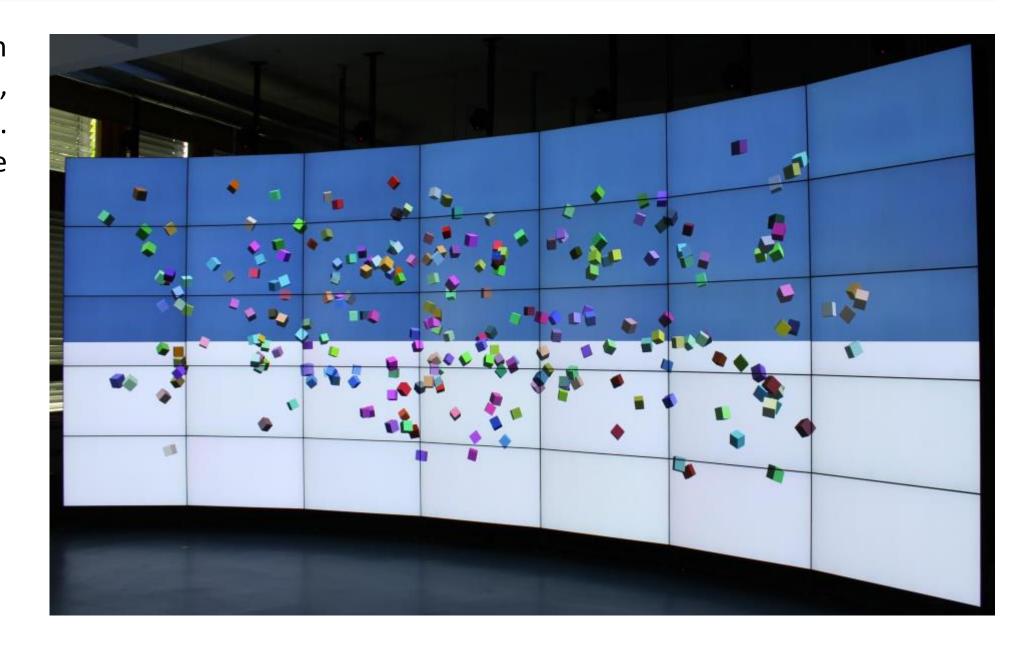
rotate around their local Y-axis. Only a subset of

all objects lay within the mutual frustum.

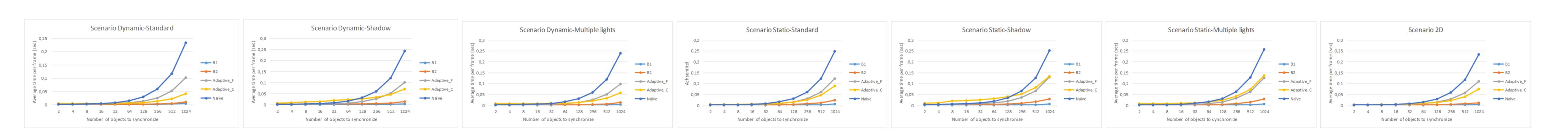
The evaluation was performed using a large curved tiled display wall comprising 35 LCD displays, ordered through a seven (column) by five (row) grid. Each of the columns has a relative angle difference of 10 degrees along the Y-axis to adjacent columns, as such creating a slight curvature. The LCD displays are 46" panels with a 1080p resolution, resulting in a total of 72 megapixels. The installation is driven by a cluster of three PCs, each equipped with three GeForce GTX 780 Ti, providing a total of twelve outputs per PC.







Results



Authors Institutions





Hochschule **Bonn-Rhein-Sieg** University of Applied Sciences

Anton Sigitov Anton.Sigitov@h-brs.de

Oliver Staadt Oliver.Staadt@uni-rostock.de

André Hinkenjann Andre.Hinkenjann@h-brs.de