

# Buster: A Budget Minded Cluster for Distributed Visualizations

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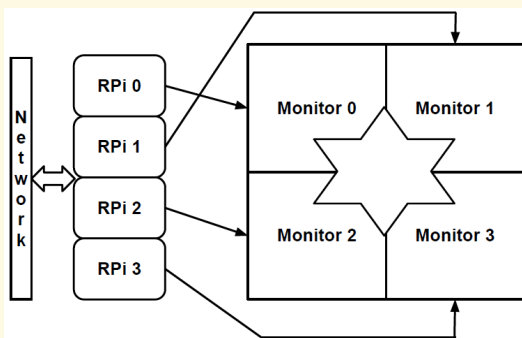
## Abstract

Traditionally, high performance computing comes with a high price tag. This project disrupts that idea by creating a compute cluster with minimal financial investment thereby increasing the accessibility of such high performance computing environments. To achieve the goal of a budget minded cluster we combined multiple Raspberry Pi computers to create a cluster that mimics a traditional distributed system. Additionally, displays can be connected to one or more of the devices and it becomes a system capable of distributing the rendering of an image.

## System Configuration

As the System Model depicts there are three different components that make up Buster. The first is the Raspberry Pi system boards. These devices consume are powered by a standard Micro USB cell phone charger and are fully capable computers running the Raspian Linux distribution which is stored on a SD flash memory card. Each Pi is connected via Ethernet cable to a network router. The router allows the each device to communicate between all devices on the network. Lastly and optionally, a display may be connected to serve as a point of video output.

## System Model



## Project 1: Display Wall

### Supporting Software

- ❖ **OpenMPI** – Open Message Passing Interface –facilitates communication between each Raspberry Pi
- ❖ **OpenCV** – Open Computer Vision – enables extraction of frame datafrom video files
- ❖ **OpenGL ES** – Open Graphics Language for Embedded Systems –used to draw the video frames on the screen

### Distributed Display Process

The distribution of a single graphic or an entire video follows the same process described below, it is just a matter of repetition.

Assign video section with OpenMPI

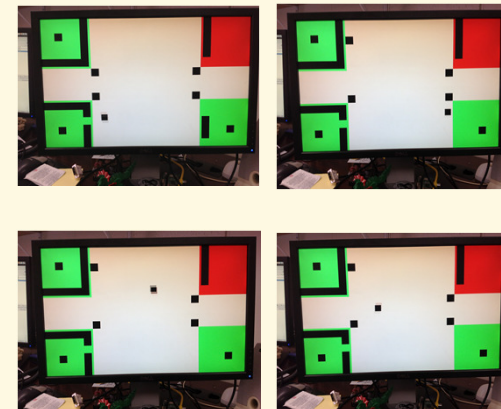
Load Video with OpenCV

Synchronize drawing via OpenMPI

Display each frame with OpenGL ES



## Project 2: Four Lords



### Summary

Where the display wall shows the capability of distributed processing. This project is essentially the next step. By creating a multiplayer imitation of Four Lords in an environment produced by the Raspberry Pi, we can then combine the two projects to see where this technology can ultimately lead us to. With these findings, the ability to simulate an environment with distributed processing can be made available at a more affordable rate.

### Outcome

The project goals of creating a cluster computing environment on a small scale budget and creating a distributed visualization system were successful.

Future research can be made into a hardware rendering pipeline that supports frame synchronization via network input, thus allowing for higher resolution and a higher frame rate of the resulting video.

### Acknowledgements

University of Wisconsin-Eau Claire  
➤ Office of Research & Sponsored Programs