## Technology Fee Award Budget Report

### Part 1 of 2: Budget Summary

<table>
<thead>
<tr>
<th>NDSU ORGANIZATION OR UNIT</th>
<th>Award No.: 1308</th>
<th>Servers: #186519, #186520</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architecture and Landscape Architecture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PROJECT DIRECTOR(s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ben Bernard</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>A. Salaries and Wages (Number)</th>
<th>Number of Months</th>
<th>FUNDS REQUESTED</th>
<th>FUNDS AWARDED</th>
<th>FUNDS EXPENDED</th>
<th>BUDGET BALANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Graduate Students</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>3. Undergraduate Students</td>
<td></td>
<td></td>
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<tr>
<td>B. Total Salary and Wages (Sum A.1., A.2., and A.3.)</td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>C. Fringe Benefits</td>
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<td></td>
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<td></td>
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<tr>
<td>D. Total Salaries (Sum B and C)</td>
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<td>0.00</td>
<td>0.00</td>
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<tr>
<td>E. Equipment (List each item)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Server #186519</td>
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<td></td>
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<tr>
<td>Server #186520</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>F. Total Equipment (Sum items in E.)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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</tr>
<tr>
<td>G. Materials and Supplies (List each item)</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
</tr>
<tr>
<td>H. Total Materials and Supplies (Sum items in G)</td>
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<td>0.00</td>
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<tr>
<td>I. Total Salaries; Equipment; Materials and Supplies (Sum: Line D + Line F + Line H)</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>J. Total Technology Fee Request</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
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<tr>
<td>K. Match</td>
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<td></td>
<td></td>
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<tr>
<td>L. Total Project Expenditure (Sum: Line J + Line K)</td>
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<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td></td>
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</tbody>
</table>

**Name (Type or Print)**

<table>
<thead>
<tr>
<th>Project Director: Benjamin Bernard</th>
<th>Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ben Bern</td>
<td>4/11/2017</td>
</tr>
</tbody>
</table>

**Unit Head: David Bertolini, PhD**

**RECEIVED**

APR 28 2017

Office of the Vice President for Information Technology
## Technology Fee Award Budget Report

### Part 2 of 2: Specific Details

#### Milestones

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Expected outcome</th>
<th>Actual Outcome</th>
<th>Means of assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Install servers in Kλai 10A with required software</td>
<td>Begin testing &amp; documentation</td>
<td>Testing &amp; documentation completed</td>
<td>Successful student tests &amp; complete render jobs</td>
</tr>
<tr>
<td>Enable students to use distributed rendering with 3DS Max Design and Maxwell Render for projects.</td>
<td>Allow a student from any ALA RCDC lab to submit a rendering via the network to free up local computer resources.</td>
<td>Students were able to submit via network rendering with the attached guides. The &quot;Render Farm Setup&quot; and the &quot;Maxwell Render From Ren&quot; PDF</td>
<td>This was assessed by Professor Mark Barnhouse, titled &quot;Render Farm Memo 021014.docx&quot;</td>
</tr>
</tbody>
</table>

#### Equipment

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Quantity</th>
<th>Cost/Item</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dell PowerEdge R710</td>
<td>2</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

#### Materials & Supplies

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Cost/Item</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
</tbody>
</table>

### Project Overview/Budget Summary

Surplus equipment was utilized to physically install the servers and network them. An surplus desktop computer was utilized as a low-power manager server. Attached is the "Render Farm.png" file, showing the physical installation. This project allowed students to use the dedicated servers to render photorealistic images from 3D design models. As an example, a department design workstation took 1.5 weeks to render what the servers took 39 hours to complete (High rise 39 hours.png). This allows computers in the department design research lab to be used for 3D modeling, centralizing resources for a specific purpose to make general resources available to the entire ALA student body. This is especially important at the end of the semester when computing resources are in high demand. Documentation was created and custom training offered to ensure maximum student use of this new computing resource.
From: Rohwedder, CeCe  
Sent: Tuesday, April 25, 2017 11:14 AM  
To: Bernard, Ben  
Cc: Enderson, Teresa; Bertolini, David  
Subject: RE: Marc/Ben: prepare status report for TFAC #1308  
Importance: High

This is wonderful, Ben!

One last step for you: please print your report that I’ve attached here, sign it, obtain Dr. Bertolini’s signature, and send the signed document to me. I will then present it to Marc for approval.

Thank you,
CeCe

CeCe Rohwedder  
Assistant to the Vice President / Information Technology  
NORTH DAKOTA STATE UNIVERSITY

Quentin Burdick Building 206B  
NDSU Dept 4500, PO Box 6050  
Fargo ND 58108-6050  
USA  
phone: 701.231.5646  
fax: 701.231.8641  
cece.rohwedder@ndsu.edu  
www.ndsu.edu

From: Bernard, Ben  
Sent: Monday, April 10, 2017 2:57 AM  
To: Wallman, Marc <marc.wallman@ndsu.edu>; Rohwedder, CeCe <cece.rohwedder@ndsu.edu>  
Cc: Enderson, Teresa <teresa.enderson@ndsu.edu>; Bertolini, David <david.bertolini@ndsu.edu>  
Subject: Re: Marc/Ben: prepare status report for TFAC #1308

Enclosed in the attached zip archive is the completed reporting form and supplementary documentation, sample rendered files of student work, and both student and faculty narratives.

Let me know if you need anything else!

---

Ben Bernard  
Computer Services Specialist  
Department of Architecture & Landscape Architecture  
North Dakota State University
From:
Mark Barnhouse  
Associate Professor of Practice  
Department of Architecture and Landscape Architecture  
College of Arts Humanities and Social Sciences  
North Dakota State University  
Fargo, North Dakota  
mark.barnhouse@ndsu.edu

To:
Ben Bernard  
Computer Services Specialist  
Department of Architecture and Landscape Architecture  
College of Arts Humanities and Social Sciences  
North Dakota State University  
Fargo, North Dakota

Ben:

This memo represents my evaluation to date of your Render Farm Project. Some history is called for here.

By 2006 sophisticated three dimensional design software had become affordable and made its way into the design professions and design schools worldwide, here in our department as well. While the design capabilities of the software was astonishing the rendering times were sluggish. Queues built up in the Ehly Computer Lab slowing the production of final projects for both ARCH 771 Advanced Architectural Design in the fall and ARCH 772 Design Thesis in the spring. I asked you to cast about for some reasonable solutions.

One of the first things you examined was the specification for the second year laptops. This specification has been considerably tightened over this period but by the time the students reach their fifth year the processors, memory, and video cards are obsolete. This same dynamic has been at work in our labs and the software vendors don’t quit. Every year new versions of the software have been released requiring more computing power. While that industry is trying to move to subscription vending rather that yearly licenses, this is unlikely to help us or anyone else
in our position. Subscription software licenses just mean that the software will be updated constantly and more computing power will be required on a monthly basis rather than yearly. The problem could not be solved by brute force, bringing more high performance desktops into the labs. There is not room in either lab for any more machines nor is there money to replace every one every year. The software drives the hardware and so we ran up against limitations which could not be solved with standard hardware. What we needed was a way to extend the power of the student laptops and lab computers by taking the heavy work of rendering and animating off their shoulders. Hence the Render Server Project.

Servers are not a new technology. Our current digital environment would not be possible without them. In the beginning of their deployment in science and industry they were very expensive and finicky to maintain but you kept a close eye on their price and availability and as with everything in the digital realm the price came down and they became easier to use. Last academic year found some excess servers at the university and submitted a grant application to have them sent to us. You were successful.

In the 2012-2013 academic year you installed the render servers in Klai Hall. While the installation and network connection took time to complete it was ready for testing during the spring semester Thesis Studio and a number of my students used it for the renderings of their thesis projects. These early experiments were very encouraging. The Render Server project was successfully completed last summer ready for use this past fall.

This academic year for the first time I felt there was sufficient computing power available to the students, with the render servers in place, to require them to animate both their Water Analysis project and their final design project. This they were able to do with good success.

The Render Server Project has proved to be very successful. It has improved the usefulness of both the student laptops and all of the computers in our two labs, it has enhanced the digital skills of our students allowing them to accomplish more sophisticated design work, and has bolstered the reputation of our department as a forward looking place.

Regards,

Mark Barnhouse

Cc: Dr. David Bertolini, Chair
    Department of Architecture and Landscape Architecture
So...
you want to
network render
with Maxwell Render
from Renaissance Hall
Things to note about network rendering from Renaissance,
No missing materials
Do not "reset" the servers in the Network Monitor. It shuts off all of the programs necessary for it to run on all computers and those will need to be manually restarted.

You do not need to open Maxwell Render, Studio, or Sketchup, or any other program not specified in this documentation to run your network render. Have the MXS file ready, and if you're moving it from sketchup, have all the materials it's bringing with it.

If you have an issue, please make sure that you have closely read the documentation.
Do not try to network render from Sketchup, Maxwell Render or Studio, you need to follow this document to network render from Renaissance.

Apply materials and setup the job however you prefer. I set this up in Maxwell Studio after importing it from Sketchup. Use Maxwell Fire to verify that the render looks proper, rather than rushing to the server with an improperly setup job and wasting time.
Type in "cmd" and hit "Enter" on your keyboard.
DO NOT CLOSE COMMAND PROMPT DURING YOUR RENDER

Step 1
Type "cd" Hit Enter.

Step 2
Type "cd Program Files\Next Limit\Maxwell 2" Hit Enter.
That should leave you with the path indicated at the
bottom of C:\Program Files\Next Limit\Maxwell 2>

Step 3
Type " mnetwork.exe -monitor:134.129.80.76" Hit Enter.
Beneath the directory of C:\Program Files\Next Limit...
It should show -monitor:134.129.80.76
and be unable to enter more characters.
FAILURE

If the command was typed improperly, or a program isn’t running, this window will pop up. Identifying that the local machine (REN:2) in this case is available to network render.
This is a successful connection to the Network Render server with Maxwell. It shows the servers running the Maxwell Render Nodes that are online.
Click the "+" symbol in the top left as highlighted to add a job.
This window will pop up, select "Cooperative Job" as seen here. Click "Next" to proceed.
The Add a Network Job Wizard will pop up. Adjust the maximum time the render will take, Sampling Level, and Resolution here. Once satisfied, select the button to find the Scene File as highlighted.
Find the Maxwell Scene File that you've saved, and select it. I've saved mine to the desktop. Once you've selected it, click "Open".
Next, click on the button highlighted to select where to save your image. This is critical otherwise the job will not save properly, and will fail.
Navigate to the "Render Farm" hard drive under computer. Select the file type (.png, .jpg, etc.) to save it as, include your name in the file name. Select "Save" when done.
Now Select where to save the Maxwell Mxi File if you so desire. If you don't want it, simply uncheck the "X" box as highlighted.
This is the same process as before. Navigate to the "Render Farm" hard drive, label your file with your name and the descriptive name you choose. Click "Save" as highlighted when done. If you didn't save a MXI file with this, ignore this step.
Scroll down the page until you reach the "Additional Options" menu. Make sure "Send Dependencies" box is ticked, and that you locate the "Dependencies Path" by clicking on the folder icon highlighted.
This image indicates the box that will pop up and where to find dependencies for the job. This is a job loaded from Sketchup, so it still needs to link Sketchup materials that are still associated with the job. Once the "textures" folder is selected, click "OK" as highlighted.
You will be returned to this box. Once you've set your time limit, resolution, and sampling level to your specifications, hit 'Next' as highlighted.
This should show servers that are online, once that is verified, hit "Finish"
DO NOT CLOSE MAXWELL NETWORK MONITOR DURING YOUR RENDER

Once done, you'll see a slew of occurrences in the prompt, and your job should be running provided you've done as this document recommends.
Final image after 25 Sampling Levels and 30 minutes of work with 2 servers running
Hello,

My name is Brett Rathbone, 2014 Master’s graduate of Architecture from NDSU. I utilized the render farm during the 2012-2014 year from a proof-of-concept to a finalized installation. It afforded me the ability to use my laptop for continued modeling of projects, and further project development overall while the render farm allowed me to make a photorealistic rendering elsewhere. I used a great deal of these projects in my portfolio when first looking for a job out of school. I was able to acquire employment—not solely, but in part—thanks to my experience with rendering.

The render farm made it much more viable to really try stuff since you didn’t have to wait for it to be successful or a failure as long. I tried on a new high-end lab computer, that took 1.5 weeks of continuous 100% CPU utilization to render. The render farm did it in 39 hours. The image right by this was what I had rendered of a “High-Rise” project. All the glass really takes up processing power, so with the farm I was able to turn out this rendering with all the details at the highest quality. This was previously unheard of for me.

I included that image on the next page, and a full-size version in my statement about this. I have also attached hyperlinks to my youtube videos that I created on the render farm as well during my tenure at NDSU. It really did allow me to try stuff out with equipment made to do that stuff rather than cooking my personal laptop.

Brett Rathbone 3DS Video 1
Brett Rathbone 3DS Video 2
Brett Rathbone 3DS Video 3

Regards,
Brett Rathbone
High Rise 39 hours
SO...

YOU

WANT

TO USE THE

RENDER FARM
Change all the settings in the "Common" tab.
Select "Files" and locate the path to the network drive "3ds R:"
This is found via "Computer"
Then via “3ds R:”
Your file path should look like that
Name your file and select the format it will be saved in.
The “Render Output” path should look like that. Once your render settings are set, click the arrow next to the “Render” button and “submit to network rendering.”
If the “manager is not selected or entered as “rendermanager” enter it and hit “Connect.” Also make sure Split Scan Line is selected and Include Maps is selected. Select “Define” by Split Scan Lines
Make sure the number of strips is two, so as to avoid unnecessary splitting of the image. The image will automatically be joined once the render is complete.
Make sure "Renderone-pc" and "Rendertwo-pc" are both selected, as is "Use all servers"
Once completed, your job will be found in the 3ds drive R:
1. NEVER CLOSE MANAGER Closing it will stop the servers from rendering jobs and the jobs in queue will need to be resubmitted.

2. ALWAYS have your materials properly set up, if there are any missing, the job will constantly fail and tie up the render farm

3. DO NOT restart the computer