Request for Technology Fee Funds
NOTE: A separate request should be made for each initiative.

I. Department Number/Department Name: | 360 | College of Computing/CS

Title of Request *(please be brief):* **Classroom Clouds**

Amount of Request *(formula from detailed budget below):* **$75,250**

Executive Summary of Request (100 words or less):

Using 2008 TechFee funds, the systems group in CoC was the first to deploy an instructional cluster that uses virtualization technologies – those used in cloud computing systems – to provide students with entirely new capabilities for learning about the intricacies of today's complex cloud and enterprise computing systems. The focused use of that cluster has been for giving students the ability to build, configure, and change their own operating systems, without requiring access to raw machine.

Specific class and/or lab initiative(s) if applicable: CS3210,CS4210,CS6210,CS6230,CS6235,CS7210,CS4365/CS880

Contact person for this request *(incl. phone #):* **Chad Huneycutt, 678-992-9109**

Indicate priority per department if applicable: Number **1** of **10**

Indicate priority per college or unit: Number ___ of ___

II. Impact on Students - Provide an estimate of how many students will be impacted if your request:

	No. of Students
Graduate	220
Undergraduate	660
Total	880

III. Narrative - Provide narrative justification for your intended use of the technology fee funds. Include narrative on how the education or research of the students will be enhanced. Also include how the request aligns with the Strategic Plan of Georgia Tech. Continue in the block below if necessary.

We are proposing an essential update to the "factor" instructional cluster. 1) to make it possible to continue its successful use, as the existing equipment is aging (there have been recent hardware failures leading to problems with classroom projects) and lacking in scale (i,e, we have too few machines with too little storage and too little memory to permit students to carry out the projects they are asked to perform), and 2) to enable entirely new functionality that has since appeared as widely available and used open source software. 1) is evident from the cluster's current condition and use, but 2) bears additional explanation, which appears next.

A new development in open source software has been the creation of widely available and used 'cloud computing' infrastructures. We propose to adopt the OpenStack infrastructure for classroom use, replacing the 'homegrown' infrastructure used in our current teaching cluster. The following new functionality offered by OpenStack will enable us to further enrich instruction and facilitate equipment maintenance.

IV. Detailed Budget - Requested Items by Category *List separately list any equipment, software, and other allowable expenses (see Tech Fee Guidelines). There is a formula in the "total column" that multiplies the number of items times the unit price. You may enter a figure into the total column if the unit pricing is not applicable. If you need additional rows, contact the Budget Office to receive a modified form.*

	Proposed Number of Items	Estimated Price per Unit	Total ($)
Dell PowerEdge R620	10	6,500	65,000
48 port Gigabit switch	1	600	600
Network & Power cables	1	150	150
APC in-rack PDU	1	2,000	2,000
Dell PowerEdge R510 (VM image storage)	1	7,500	7,500
Total *(linked to the total amount of request line above)*			**$75,250**

Please return form via e-mail in Excel format to: tina.clonts@business.gatech.edu   10/12

III. Continuation of narrative justification, if necessary

1) OpenStack makes it easy to maintain, launch, and deploy the virtual machines used by students, lessening administrative costs. 2) With OpenStack, we will be the first institution in Georgia that permits students to work in an environment akin to what happens in today's large-scale datacenters run by companies like Google, Yahoo, Microsoft, IBM, and others, thus better preparing them for the industry positions many of these students will accept after graduation. Toward that end, we will not only give students their own VMs, but will also give them (to experiment with) entire, multi-VM datacenter applications and workloads, based on well-understood benchmarks with which we have been working (all active in Apache.org). Essential for this task is an increased cluster size, however, as students will run multiple VMs, not just single ones! 3) We will explore newly arising paradigms in cloud computing, focused on data-intensive (i.e., Big Data) applications, for which we are well-prepared given our role in one of the key 'Big Data' initiatives announced by the U.S. this past May 2012 (we are part of DOE's SDAV effort). 4) We will explore multi-site collaborations, specifically, collaboration with Carnegie-Mellon University, as we are already collaborating with CMU in research as part of our participation in the 'Intel Cloud Computing Science and Technology Center' at CMU, and we are members of the national OpenCirrus cloud computing initiative (led by HP and Intel), which is already investigating educational support by clouds for classroom instruction. In summary, we are requesting additional virtualization hosts, as well as the infrastructure required to integrate them into the current cluster. We estimate that we need 10 additional servers to run up to 500 VMs simultaneously and permit multiple, concurrently operating student teams to experiment with the types of multi-VM, distributed applications now routinely used in industry (e.g.., Hadoop-type Mapreduce codes, distributed file systems like those run at Google, etc.). The current hardware is limited to approximately 200 VMs, given the resource-intensive activities that take place in the VMs (compilation, benchmarks, etc.). Additional host nodes will also provide better isolation for projects that involve network evaluation, as well as provide additional "hack farm" partitions.