In your third homework assignment, which is built on your second homework, you will gain experience with building a private cloud on top of which you will run the program that you created in your HW2 using the map/reduce model for parallelizing software testing. This homework is done in teams, each consisting of seven to nine members. If you a lone wolf who does not like to work in teams, your cost will be higher, but you can do this homework alone. I expect that you form teams and notify me by email and CC to the TA no later than October, 7, at noon CST. Your email should be sent from the team leader (hopefully, elected by the other members of the team) and CCed to the other members of the team and to the TA. In the email please state the full names of the members of your team and the class code, i.e., CS441. Teams may include both graduate and undergraduate students. Failure to form a team and to send an email by the deadline will lead to the loss of one percent per day of the delay until the entire HW3 grade is lost.

The goal of this homework is to create a private cloud from Raspberry PI or equivalent single board computing devices. Each member of the team is required to purchase Raspberry PI 3 Model B 1.2GHz 64-bit quad-core ARMv8 CPU, 1GB RAM or an equivalent single board computer. You can find it on Amazon for approximately $35 plus some expenses for peripheral devices. Since you are not required to purchase any textbook for this course, your have saved money to purchase a single board computer. With it, a team of eight people can build a cluster of Raspberry PI devices, aka as OctaPi. You can find many examples of building a computing cluster from single board computing devices, one of which can be found here https://projects.raspberrypi.org/en/projects/build-an-octapi and here http://www.zdnet.com/article/raspberry-pi-how-i-built-an-octapi-style-computing-cluster/#ftag=RSSbaffb68.

The next step is to install Kubernetes, an open-source platform designed to automate deploying, scaling, and operating application containers https://kubernetes.io, on Raspberry Pi and experiment with container orchestration. Again, you will find a lot of documentation on the Internet, and you may follow the workshop published on github: https://github.com/luxas/kubeadm-workshop/blob/master/README.md. You may use this article that contains a lot of useful information https://diffuse.cloud/2017/06/19/kubernetes-raspberry-pi/. Once you install Kubernetes on your OctaPi cluster, you can integrate Apache Hadoop with Kubernetes and then run your HW2 on top of this cloud. You can find more information in his Hortonworks article https://hortonworks.com/blog/docker-kubernetes-apache-hadoop-yarn/.

You can post questions and replies, statements, comments, discussion, etc. on Piazza. For this homework, feel free to share your ideas, mistakes, code, scripts, commands, and your other solutions beyond your group for a team homework, and you can ask and advise others using Piazza on where resources and sample programs can be found on the internet, how to resolve dependencies and configuration issues. When posting question and answers on Piazza, please select the appropriate folder, i.e., hw3 to ensure that all discussion threads can be easily located. Active participants and problem solvers will receive bonuses from the big brother :-) who is watching your exchanges on Piazza (i.e., me).

Submission deadline: Thursday, November 16 from 3:30PM to 6:30PM CST in my office, with one or more members of your team demonstrating the work of the private cloud. Your email submission will include a link to a git repo (you can create your own and make it public only on the day of the submission) with the source code of the program, the documentation with instructions and detailed explanations on how assembled and deployed your cloud with links to images and movie clips taken from your intermediate steps, and what the limitations of your implementation are. The last image should be a picture of the members of your team with names. Your entire team does not have to come to my office. I expect you to bring your cluster and connect to my monitor and my keyboard, so that I can see the orchestrated containers and ask you questions about the installation and deployment. I may ask you to run the application and observe the status using an admin console. I expect you to email the documentation submission to me no later than November, 18 at 10PM to drmark@uic.edu in the PDF format. You will receive an email confirmation from me.

Evaluation criteria:

- the maximum grade for this homework is 10% with additional up to 3% bonus points for interesting findings. For example, installing Hadoop on top of OSv will definitely earn some bonus points. Points are subtracted from this maximum grade: for example, saying that 2% is lost if some requirement is not completed means that the resulting grade will be 6%-2% => 4%; if the core homework functionality does not work, no bonus points will be given;

- only OctaPi cluster is assembled and nothing else is done: up to 5% lost;

- no documents that describes the assembly and deployment of your cloud: up to 7% lost;

- missing the map/reduce program to run from HW2: up to 3% lost;

- the program crashes without completing the core functionality: up to 2% lost;

- the documentation exists but it is insufficient to understand how you assembled and deployed all components of the cloud: up to 5% lost;

- Kubernetus is not installed, only Hadoop is installed on the OctaPi cluster directly: up to 6% lost;

- the minimum grade for this homework cannot be less than zero.

That's it, folks!