Cloud Computing (CS-GY 9223) Syllabus
(Tue Aug 08, 2017 09:16 AM - Sun Dec 31, 2017 08:00 AM)

Title: Cloud Computing (CS-GY 9223)

Description: In this course, we will investigate cloud computing and the evolving technologies that support applications in the cloud. These technologies include Platform as a Service (PAAS), Infrastructure as a Service (IAAS), Software as a Service (SAAS), Business Process Modelling (BPM), SOAP and REST web-services and document oriented NOSQL databases. Students will complete a programming project that will integrate data from many heterogenous cloud systems and a mobile system. Over the duration of the course, the student will develop a research hypothesis on how to solve a specific problem in cloud architectures by utilizing a proposed improvement in one of the areas we studied over the semester. The student will test their hypothesis with an implementation and disseminate the results of the research work in the form of an IEEE extended abstract.

Online Modules

Introduction

This lecture will give you a broad overview of the course, as well as the description of cloud computing, service-oriented computing, business process management and document data stores.

1. Platform as a Service

   This lecture covers the basic concepts of Platform as a Service (PAAS). Several examples will be demonstrated and follow-up programming tasks will be assigned to allow the student to experience applied PAAS. In this module students will be introduced to several PAAS offerings including force.com, Google App Engine, and Zoho Creator. The force.com APEX programming language for developing PAAS applications. Students will be assigned a creative project where they design and implement a user-interface in the force.com PAAS that allows users to maintain an object and perform all CRUD operations on the object.

2. Infrastructure as a Service

   This lecture covers the basic concepts of Infrastructure as a Service (IAAS). Several examples will be demonstrated and follow-up configuration tasks will be assigned to allow the student to experience applied IAAS. In this module students will be introduced to several IAAS service offerings Amazon EC2, Microsoft Azure, digital ocean and Heroku. Students will be assigned the creation of an application in Heroku to manage an object and have the data asynchronously replicate with their first assignment solution.

3. Software as a Service
This lecture covers the basic concepts of Software as a Service (SAAS). Several examples will be demonstrated and follow-up usage tasks will be assigned to allow the student to experience applied SAAS. In this module students will be introduced to Google G-Suite, Microsoft Office 365 and several Zoho solutions. Students will be assigned a simple task to create and manage an object like their first two assignments in a SAAS provider.

4. Web-Services
This lecture covers the basic concepts of Web-Services. Both SOAP and REST web services will be explained. Students will be given follow-up programming tasks to develop web services in the Cloud and to call out to other web-services. Students will develop server-side REST and SOAP web-services for their first assignment on the force.com platform. The students will demonstrate test cases for their web-services using SoapUI and postman test scripts.

5. Authentication in the Cloud
This lecture covers the basic concepts of current process authentication in the cloud. The focus of the lecture will be on OAuth authentication workflows and the shortcomings. Students will be given follow-up web service testing assignments that utilize process authentication. The assignment for this module will require students to secure their earlier web-services for authentication. The earlier test scripts will need to be updated to include authentication in the workflows.

6. Mobile applications and the Cloud
This lecture covers the basic concepts of how native mobile applications are developed to communicate with the cloud. The focus of the lecture will be on native mobile apps calling REST web services. Students will be given follow-up programming assignments that implement simple webservice calls from an Android emulator.

7. Semi-Structured Data Formats
This lecture covers the basic concepts of semi-structured data formats. Both JSON and XML data services will be explained. Students will be given follow-up programming tasks to manipulate semi-structured data and execute queries through non-procedural query languages.

This lecture covers the basic concepts of business process management (BPM). The focus of the lecture will be modeling process and data flow in the Cloud and across domain boundaries. Students will be given follow-up modeling tasks using the Visual Paradigm BPMN modeling tool. Server-side workflows will be exampled in PAAS providers and contrasted to the BPEL programming language. Students will be assigned the development of a server-side workflow in the force.com business process engine.
9. Document Oriented Data Stores

This lecture covers the basic concepts of document oriented NoSQL databases. The focus of the lecture will be the difference between relational databases and document oriented databases and the benefits and deficiencies of both architectures. Students will be introduced to several NoSQL databases including: CouchDB, MongoDB and Google Big Table. Students will be given follow-up programming tasks to create and query documents in a document oriented database. The assignment for this module will be to create a CouchDB database to hold the object data used in previous assignments. Students will write map/reduce queries to retrieve individual records and aggregate details about the records.

Evaluation Criteria: Grade will be based on quality of research and paper written along with the completion of the online modules.

32% = Module Assignments
32% = Research Project
4% = 2nd Authorship
32% = Project Score

Module Assignments

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<tr>
<th>Module</th>
<th>Assignment</th>
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<tbody>
<tr>
<td>PAAS</td>
<td>Design and implement a user-interface in the force.com PAAS that allows users to maintain an object and perform all CRUD operations on the object. In the recorded lecture, an example will be developed to manage a person object.</td>
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<tr>
<td>IAAS</td>
<td>Install Heroku containers to host server-side code along with a module to host a Postgres SQL database. Develop a web interface to perform CRUD operations on the custom object of your choice. In the recorded lecture, an example will be developed to manage a person object. Install the Heroku/Salesforce integration container to asynchronously replicate the data between the Postgress database and the PASS data store.</td>
</tr>
<tr>
<td>SAAS</td>
<td>Sign-up for the Zoho CRM SAAS application. Modify or create a Zoho CRM module to hold the fields used for your object in previous assignments.</td>
</tr>
<tr>
<td>Web-Services</td>
<td>Develop REST and SOAP End-Points in force.com to allow CRUD operations on your custom object from the PAAS assignment. Develop PAAS code that calls the REST web-services to perform CRUD operations for your object on the SAAS system. Develop test SOAP call code in SoapUI testing engine. Develop test REST call code in the Postman testing engine. In the recorded lecture, examples of all these tasks will be demonstrated.</td>
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Authentication
Secure your REST and SOAP web-services using OAUTH. Modify your test scripts so they can function with the new authentication requirements in the workflows.

Mobile
Develop a mobile app to call Yahoo finance REST web services. The App should request a stock code and display the current price. The code can be developed in App Inventor or native IOS or Android Java code. In the recorded lecture, an example application will be developed.

Semi-Structured Data
XML documents will be provided and students will need to provide XQueries that return the requested data.

BPM
Students will design and implement a server-side workflow model to update data in the Zoho CRM SAAS from the force.com PAAS. The students should ensure changes made in their custom object are replicated between the two systems using a push of changes made in the PAAS via web-services and a pull of changes from the SAAS.

Document Data Store
Students should design a new CouchDB database that can hold their custom object used through the course. The students should provide map/reduce queries to pull specific instances of the object along with at least two aggregate queries.

Research Assignment
Over the semester students will work on an individual Cloud Computing hypothesis. The student will disseminate the results in the form of an extended abstract.

The paper will have the following contents:

- Title
- Your name, 2nd author name, my name
- Abstract
- Introduction
- Related Work
- Hypothesis, Implementation & Results
- Conclusions
- Virtual Presentation

All student will produce a PowerPoint presentation (not more than 15 slides) with audio, which will be uploaded on youtube.

1. The presentation should be between 15 to 20 minutes.

2. You are expected to give a brief introduction:

a) “This presentation is for the ____________ conference"
b) Title of your presentation;

c) Your name, 2nd author name, my name and affiliation (New York University).

3. It is important to include the email address, so that participants will be able to get in touch with you if they have further questions.

2nd Authorship

Every student will partner with another student to be the 2nd author on the paper. The 2nd author will submit comments and changes to the first authors paper. You should spend 1/2 to 1 hour per week reading and commenting on the other paper.

Paper Rubric:

<table>
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<tr>
<th>Criteria</th>
<th>EXPERT 4 points</th>
<th>PROFICIENT 3 points</th>
<th>APPRENTICE 2 points</th>
<th>NOVICE 1 point</th>
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<tbody>
<tr>
<td>INTEGRATION OF KNOWLEDGE</td>
<td>The paper demonstrates that the author fully understands and has applied concepts learned in the course. Concepts are integrated into the writer's own insights. The writer provides concluding remarks that show analysis and synthesis of ideas.</td>
<td>The paper demonstrates that the author, for the most part, understands and has applied concepts learned in the course. Some of the conclusions, however, are not supported in the body of the paper.</td>
<td>The paper demonstrates that the author, to a certain extent, understands and has applied concepts learned in the course.</td>
<td>The paper does not demonstrate that the author has fully understood and applied concepts learned in the course.</td>
</tr>
<tr>
<td>TOPIC FOCUS</td>
<td>The topic is focused narrowly enough for the scope of this assignment. A thesis statement provides direction for the paper by stating the hypothesis</td>
<td>The topic is focused but lacks direction. The paper is about a specific topic but the writer has not established a position.</td>
<td>The topic is too broad for the scope of this assignment.</td>
<td>The topic is not clearly defined.</td>
</tr>
<tr>
<td>DEPTH OF DISCUSSION</td>
<td>In-depth discussion &amp; elaboration in all sections of the paper.</td>
<td>In-depth discussion &amp; elaboration in most sections of the paper.</td>
<td>● The writer has omitted pertinent content or content runs-on excessively. Quotations from</td>
<td>Cursory discussion in all the sections of the paper or brief discussion in only a few sections.</td>
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others outweigh the writer's own ideas excessively.

COHESIVENESS
Ties together information from all sources. Paper flows from one issue to the next without the need for headings. Author's writing demonstrates an understanding of the relationship among material obtained from all sources.

For the most part, ties together information from all sources. Paper flows with only some disjointedness. Author's writing demonstrates an understanding of the relationship among material obtained from all sources.

Sometimes ties together information from all sources. Paper flows with only some disjointedness. Author's writing does not demonstrate an understanding of the relationship among material obtained from all sources.

Does not tie together information. Paper does not flow and appears to be created from disparate issues. Headings are necessary to link concepts. Writing does not demonstrate understanding any relationships.

SPELLING & GRAMMAR
No spelling &/or grammar mistakes.

Minimal spelling &/or grammar mistakes.

Noticeable spelling & grammar mistakes.

Unacceptable number of spelling and/or grammar mistakes.

SOURCES
More than 5 current sources, of which at least 3 are peerreview journal articles or scholarly books. Sources include both general background sources and specialized sources. Specialinterest sources and popular literature are acknowledged as such if they are cited. All web sites utilized are authoritative.

5 current sources, of which at least 2 are peer-review journal articles or scholarly books. All web sites utilized are authoritative.

Fewer than 5 current sources, or fewer than 2 of 5 are peer-reviewed journal articles or scholarly books. All web sites utilized are authoritative.

Fewer than 5 current sources, or fewer than 2 of 5 are peer-reviewed journal articles or scholarly books. Not all web sites utilized are credible, and/or sources are not current.

CITATIONS
Cites all data obtained from other sources. IEEE citation style is used in both text and bibliography.

Cites most data obtained from other sources. IEEE citation style is used in both text and bibliography.

Cites some data obtained from other sources. Citation style is either inconsistent or incorrect.

Does not cite sources.

Overall Score

<table>
<thead>
<tr>
<th>Overall Score</th>
<th>Level 4</th>
<th>Level 3</th>
<th>Level 2</th>
<th>Level 1</th>
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<tbody>
<tr>
<td></td>
<td>Level 4</td>
<td>27 or more</td>
<td>Level 3</td>
<td>20 or more</td>
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Project

Each student will develop a semester long project that integrates data across several domains in the cloud. Over the semester each student will have built similar pieces through the learning module assignments.

Each student should include
• Include a BPMN model for your project flow
• Include a web service in a PAAS architecture to maintain an object
• Include a mobile app that can modify the data and communicate to the web service.
• Communicate with a SAAS architecture to maintain the same data object
• Include a IAAS app to maintain the object (All CRUD operations)
• Include a mobile app to maintain the object (All CRUD operations)
• Include a document oriented database that has a copy of all the data and is kept up to date.
• Include a writeup that shows screenshots of your different parts of the application and document the choices you made in the architecture of the data replication.