CSCI E-64 (24228) (4 Credits)
Mobile & Cloud Computing

Instructor:
Joseph Ficara, ASEE, Architect, Senior Staff Software Engineer, HP Software.

Course Meeting
Thursday evening’s beginning: Jan. 29th, 2015
Location: Maxwell-Dworkin G125
Held: 7:40-9:40 PM EST

About this course:
Mobile computing has become ubiquitous with over a billion devices in use every day. Although these devices are quite powerful on their own, their real power comes from their ability to connect people, entertain, and drive e-commerce by leveraging the enormous computing infrastructure and computing services in the cloud. Cloud computing itself has become a very attractive option for startups and well-established business such Pinterest, Netflix, Box, Blue Cross, SAP, and Pfizer due to minimal initial investment, low costs, and automatic elastic compute/storage capabilities. The combination of these key technologies provide a canvas to create solutions with almost limitless power, innovation, and potential. This course covers the essentials necessary to leverage these key technologies in a pragmatic way so the power, innovation, and potential can be fully realized.

In this course, we cover the key services and application programming interfaces (APIs) offered by Microsoft Azure to build highly scalable, low cost cloud computing services that bring the power of the cloud to mobile applications. The course covers caching, storage, big data via (HDFsite) Hadoop, SQL database, notification hubs, mobile services, cloud services, load balancing, schedule, multi-factor authentication, and websites. Using these services, and others, students learn how to build highly scalable, fine-grained multi-tenant, secure representational state transfer (REST) services in the cloud. Throughout the course, students learn how to build highly responsive and engaging mobile applications that take full advantage of these services on the Android, iOS, and Windows platforms. (4 credits)

This course will cover the essentials necessary utilize Azure cloud services from Android, iOS, Windows, and Windows Phone platforms. It will also cover architecture, design and usability guidance regarding how to decide what software and data executes/resides in the cloud vs on the client mobile device. Students have the choice of using native mobile code or using Xamarin to build cross platform applications. Xamarin for Android and iOS is free to all registered students of the course!

Prerequisites: CSCI-E10a, or CSCI E-33, or one year Java development, or one year of .NET development using C#. Familiarity with Android, iOS or Windows development is helpful but not required.
Section
Thursday evening’s beginning: **Feb. 5th, 2015**
Location: **TBD**
Held: **6:30 PM - 7:30 PM EST**

This will not be a point and click wizard class. It will not be possible for you to get through your course work by simply using the prefabricated code that is generated by the Visual Studio wizards. This class is about learning the services provided by Azure making mobile apps more powerful by doing so. The reason why you get paid the big bucks is because you can get through the snags that hold the point and click wizard programmers back. You will be able to use the wizards to get the framework of your application up, but at times, you will be required to rip the wizard-generated code apart to complete the assignments. Finally, some course work may explicitly prohibit the use of wizards, either because they will be of no use or because I am trying to drive a specific point home.

Course Home Page:
This class has a home page: [http://isites.harvard.edu/k107650](http://isites.harvard.edu/k107650)

Any changes posted in the "Notices" or “Discussion forum” sections of this page are officially incorporated into and made part of this syllabus by reference.

Student Participation:
We encourage student participation; please feel free to ask questions throughout the lectures. If we need to suspend questions for a brief period while we finish a particular topic we will let you know.

Use of Cell Phones, Pagers, Etc…:
We prohibit the use of all noise-making devices during class (i.e. cell phones, pagers, beepers, etc.)
Please turn these devices off prior to the start of each class. If a student’s cell phone, pager etc. goes off in class they will be asked to leave the class for the evening. Repeated offenses can result in expulsion from the course.
Sections:
Sections are optional, weekly discussion groups run by our TAs. Student questions regarding lecture material, assignments and final project will be addressed during this time. Periodically, the TAs may provide supplementary material during sections. Details of such will be announced in class and will be available on the website in the “discussion forum” and or via the “announcements” area.

Thursday evening’s beginning: **Feb. 5th, 2015**
Location: **TBD**
Held: **6:30 PM - 7:30 PM EST**

Additional sections may be held, based on class needs, via Blackboard Collaborate online. Postings for section day(s) and times will be made available on the course web site. Information on the Blackboard Collaborate login information will also be made available on the course website.

*Online and on-campus options. See [Distance Education](#).*
Optional Textbooks

If your focus will be using Xamarin for mobile development

Title: Creating Mobile Apps with Xamarin.Forms, Preview Edition
Author: Charles Petzold
Publisher: Microsoft Press
ASIN: B00NXYJ8DK

If your focus is Android development

Title: Android Apps for Absolute Beginners
Authors: Wallace Jackson
Publisher: APress
ISBN: 978-1484200209

If your focus is iOS development

Title: Beginning iOS 7 Development: Exploring the iOS SDK
Authors: Jack Nutting, Fredrik Olsson, David Mark, Jeff LaMarche
Publisher: APress
ISBN: 978-1430260226

If your focus is WinRT development

Title: Pro Windows 8 Development with XAML and C#
Authors: Jesse Liberty, Jon Galloway
Publisher: APress
ISBN: 978-1430240471

If your focus is Windows Phone development

Title: Essential Windows Phone 8 (2nd Edition)
Author: Shawn Wildermuth
Publisher: Addison-Wesley Professional; 2 edition (June 7, 2013)
ISBN: 978-0321904942

Title: Pro Windows Phone App Development
Authors: Falafel Software
Publisher: APress
ISBN: 978-1430247821

Course books are available from the Harvard Coop: [http://harvard.bncollege.com](http://harvard.bncollege.com)

You can also find them on Amazon.com: [http://www.amazon.com/](http://www.amazon.com/)
We recommend that you have access to the MSDN Library Subscription which is available for free at http://msdn.microsoft.com/library

**Hardware and Software Requirements:**

Note: This course requires **substantial programming**.

We recommend that students have their own software development environment. Although Harvard provides computer services, we have not certified that their configurations will be suitable for all assignments.

Required software is available **for free** to all registered students.

About 1 week prior to the start of the course all students registered for the course, who have valid email addresses in Harvard’s database will be submitted for DreamSpark Premium IDs.

If you have registered for the course but don’t have a valid email address registered with Harvard you will be able to provide your email address to myself or to one of the TA's during class so we can get you setup.

You can register for a Xamarin license by going here: http://blog.xamarin.com/xamarin-for-students/

For information regarding account setup and configuration follow the link: Harvard Computer Services

**Azure Development:**

Access to a personal computer with the following software installed and properly configured is required:

- Windows 8.1
  - Windows 8.1 Pro or Windows 8.1 Enterprise are also acceptable
- Visual Studio Premium 2013 with Update 4
  - Visual Studio 2013 Ultimate (With Update 4) is also acceptable
- A Microsoft Azure account
  - Details on how to set this up will be provided during our first class
    - You will not be required to purchase an Azure account
  - Azure SDK for .NET 2.5 (VS 2013 Version)
Mobile Development:

Android:

- If you are developing for Android you can develop on Windows and can obtain the development kit from here: http://developer.android.com/sdk/index.html
  - Android 4.4 (API level 19) is required
  - You can utilize the Android Studio via Java, Xamarin Studio or Visual Studio with Xamarin (Via C#) for your development environment
  - An Android Device is not required

iOS:

- If you are developing for iOS you will need a Mac running the current version of OSX as well as XCode. You will also need to be a member of the Apple iOS Developer Program. You can find out more here: https://developer.apple.com/programs/ios/
  - iOS 7 or 8 development is required
  - An iOS Device is not required.
  - You can utilize Swift or Objective C, Xamarin Studio or Visual Studio with Xamarin (Via C#)
    - Note:
      - Xamarin Studio supporting iOS development only runs on a Mac

WinRT / Windows Phone, Windows Desktop Forms or WPF:

- Windows 8.1
  - Windows 8.1 Pro or Windows 8.1 Enterprise are also acceptable
- Visual Studio Premium 2013 with Update 4
  - Visual Studio 2013 Ultimate (With Update 4) is also acceptable
- Note:
  - Software development is not supported on Windows RT (ARM) devices.
    - Running & Debugging WinRT applications are supported
  - A device running Windows 8.1 with touch support is not required.

Mobile device requirements

iOS devices, Android devices, Windows 8 Phone Devices, Windows RT (ARM) Devices are not required. You can use the associated emulators/simulators for all client work. You only need to have the corresponding development platform as noted earlier.

Having a corresponding device will enable you to better appreciate capabilities, various sensors and user interaction provided by them and is essential for building applications you will publish/sell, however having the device it's not required for the course.
**Required coursework**

This class will consist of lectures, structured homework assignments and a final project. The assignments and final project are designed to reinforce the lectures presented in class.

Since this is a graduate-level course, all student work will be held to a graduate-level standard.

The **homework** assignments will **constitute 30%** of your course grade; the **final project** will **constitute 70%** of your course grade. There will be 3 homework assignments.

Most homework assignments are designed to take approximately 10-15 hours of work for the median student in this class. The final project is designed to take approximately 70 - 105 hours. Keep in mind that students often spend more time on final projects due to their enthusiasm and creativity.

The final project consists of three mandatory deliverables: a **functional specification**, a **design specification** and the **final project implementation**. The requirements will be presented in class and consist of a core set of mandatory Microsoft Azure services, along with a set of elective elements from which the students will choose. We encourage students to think creatively when planning their final projects.

**The functional specification is worth 10% of the final project grade.** The functional specification MUST clearly communicate WHAT the final project will do and what problem it will solve by effectively utilizing screen mockups, workflows, use cases, and site map.

**The design specification is worth 10% of the final project grade.** The design specification MUST clearly communicate HOW the student will meet the core requirements and execute the elective elements in final project implementation. More specifically, this document will include:

- **Architectural block diagrams** illustrating the high level architecture and key architectural aspects of the application,
- **Sequence diagrams** illustrating complex use case implementations, and
- **Class diagrams** illustrating the object model(s) implemented.
- **A clear mapping** between the design elements and the functional specification so the TA can clearly understand how the requirements are being satisfied.

**The final project implementation is worth 80%** of your final project grade.
Grading criteria (grading percentages)

<table>
<thead>
<tr>
<th>Grade</th>
<th>A</th>
<th>A-</th>
<th>B+</th>
<th>B</th>
<th>B-</th>
<th>C+</th>
<th>C</th>
<th>C-</th>
<th>D+</th>
<th>D</th>
<th>D-</th>
<th>E (Failing Grade)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Points</td>
<td>100-92</td>
<td>91-90</td>
<td>89-87</td>
<td>86-83</td>
<td>82-80</td>
<td>79-77</td>
<td>76-73</td>
<td>72-70</td>
<td>69-67</td>
<td>66-63</td>
<td>62-60</td>
<td>Less than 60</td>
</tr>
</tbody>
</table>

It is likely that in at least one assignment you will score less than 100%. We will automatically drop the assignment with the lowest grade. If you elect not to submit one of the assignments then that assignment will count as your lowest graded assignment and will be dropped.

You cannot drop the functional specification, design specification or final project.

Since Azure Development ever-evolving at internet speed some assignments posted on the Web may be modified. I reserve the right to change them at any time, up to the end of class on the night on which they are assigned.
Coursework submission policy:
If you have any questions regarding these guidelines please ask a TA or the instructor.

Course work must be submitted using the WebSite’s drop box.

- Submissions shall be placed in zip file(s) that preserve the directory structure:
  - All zip files submitted shall contain
    - All assets such as configuration files, images, databases and resources that are part of the application.
    - A text file named ProjectNotes.txt that includes:
      - Assignment title and number
      - Your name & email address
      - The client development platform you are using
        - Android
        - iOS
        - Windows / Windows Phone / Universal App
        - Xamarin
    - Specific notes for the TA (as necessary)

- If you are using Windows Store Apps, Windows Phone Apps, Windows Desktop Forms or WPF for your client code you must submit a single zip file.
  - Single Zip File: Containing Client and Azure server code shall be placed in a Zip file called LastName_HWXX_CS.
    - Use two Visual Studio solutions
      - 1<sup>st</sup> for Mobile App Code (Client Code)
      - 2<sup>nd</sup> for Azure Mobile Service code (Azure server code)
        - Azure code shall be put under a directory called Azure
        - Client code shall be put under a directory called Client
        - XX is the homework Assignment number (01, 02, 03 etc...)
        - Example:
          - Homework assignment: 1
          - Student’s Last name: Jones
          - Zip shall be called: Jones_HW01_CS
If you are building native apps or Xamarin apps for Android or iOS you must submit two Zip Files, one for the server code and one for the client code.

- **Zip File 1**: The Azure server code shall be placed in a Zip file called `LastName_HWXX_Azure`
  - XX is the homework Assignment number (01, 02, 03 etc...)
  - Example:
    - Homework assignment: 1
    - Student’s Last name: Jones
    - Zip shall be called: `Jones_HW01_Azure`

- **Zip File 2**: The client code shall be put in a Zip file called `LastName_HWXX_YYYY`
  - XX is the homework Assignment number (01, 02, 03 etc...)
  - YYYY Designates the client code
    - Android (Written in Java or Xamarin with C#)
    - iOS (Written in XCode, Swift or Xamarin with C#)
  - Example:
    - Homework assignment: 1
    - Student’s Last name: Jones
    - Client platform: Android
    - Zip shall be called: `Jones_HW01_Android`
  - Example:
    - Homework assignment: 1
    - Student’s Last name: Jones
    - Client platform: iOS
    - Zip shall be called: `Jones_HW01_iOS`
Assignment due date/time policy:
Each assignment has a specific due date. The student must post her/his assignment to the Website’s drop box by 5:00 PM EST, the day it is due. There is a fifteen-minute grace period for late assignments (i.e., assignments turned in at 5:16 or later will be counted as one day late).

The late drop box will be configured to start accepting assignments at 5:16 PM EST. The on time drop box will be configured to accept assignments up until 5:15 PM EST.

Penalties for Late Assignments:
- 1.5 Points per day late up to a maximum of 21 points.
  Time of submission is determined by the drop box date/time stamp.
  The maximum grade you can receive when handing in an assignment two weeks late is a 79.
- Assignments turned in more than 14 days late will receive a grade of 0%
- 10 to 100 Points or expulsion for submitting an assignment that contains a virus depending on the damage done to the TAs machine.
- 5 Points for not including your name, email address, assignment title and number
- Assignments not received by May 14th, 2015 at 11:59 PM EST will be assigned a grade of 0%
  - Note: The last few assignments don’t have as long of a late submission window due to the May 14th, 2015 deadline.
- Notes:
  - You will be required to resubmit an assignment if the TA cannot successfully build what has been turned in. If this happens your assignment will be considered late, assuming it was not turned in early and resubmitted before the official due date. Remember resubmits are only accepted if requested by the TA.
  - We encourage students to hand in the functional and design specifications, and implementation one or more times prior to the final submission. The T.A.s will provide feedback and guidance on the student’s implementation of core and elective requirements.
  - There is no late penalty for the functional and design specifications; however, students are highly encouraged to turn them in at the dates specified to keep on track. They must be turned in, along with the final project, by May 14th, 2015 at 11:59PM EST. Submission beyond this date is not accepted.
Extra Credit:
It is possible to get some extra points for turning an assignment in early. We will grant you one point for each day an assignment is turned in early, up to a maximum of five points. To be considered early, the assignment's submission must be turned in by 5:00 PM EST prior to the day it's due. The 15 minute grace period applies here as well. For example:

If the assignment is due on 2/12/2015 and it's turned in on 2/11/2015 at 5:00 PM EST, it's eligible for one point of extra credit. If it's turned in on 2/11/2015 at 5:16 PM EST, it's not eligible for the one point of extra credit.

The final project, functional specification, design specification, and final project implementation are also eligible for early submission extra credit, but only if they are the final versions to be graded. Once a final version is submitted, no further submissions will be accepted unless a TA requests a resubmission, see resubmits.

Some assignments will specifically offer opportunities for extra credit. We will only provide extra credit where the assignment instructions specifically call out items that are eligible for extra credit.

Resubmits:
A resubmit is only permitted if requested by the TA. If a resubmit occurs after the due date, the late penalty will apply. If a resubmit occurs prior to the due date all extra credit points for early submission are forfeit.

Last day an assignment can be turned in:
All assignments, including the functional specification, design specification and final project are due by May 14th, 2015 at 5:00 PM EST. Any work not received by May 14th, 2015 at 11:59 PM EST will be assigned a grade of 0%.

Extensions beyond May 14th, 2015 will only be granted in cases of serious life-or health-threatening emergency. ANY OTHER CAUSE, INCLUDING, BUT NOT LIMITED TO BUSINESS PROBLEMS, TRAVEL, and COMPUTER BREAKDOWNS, DO NOT QUALIFY FOR AN EXTENSION.

If Harvard Extension cancels a class:
If the Harvard Extension School officially cancels a class, the assignment to be given at that class will be assigned at the next class and the due date will be moved accordingly. Assignments due on the night of the canceled class are still due at their original date & time.

Academic Honesty:
ALL STUDENTS ARE RESPONSIBLE FOR READING, UNDERSTANDING, AND COMPLYING WITH THE ACADEMIC RULES AND REGULATIONS PUBLISHED IN THE EXTENSION SCHOOL CATALOG, INCLUDING, BUT NOT LIMITED TO ACADEMIC HONESTY.
Discussion Forum:

To make it easier for you to talk to the TAs and to each other an internet discussion forum, has been set up on the course WebSite: http://isites.harvard.edu/k107650

If you have a question about individual grading or administrative problems, contact the TA who graded the assignment directly.

Please use the forum as the entry point for all questions whose answers might be of general interest, such as questions on the assignments.

The discussion forum will be monitored by an “on-call” TA at all times. Thus, your questions will be answered more quickly if you post them to the forum, as opposed to sending an e-mail to a TA or myself. Posting messages will also allow other students to benefit from the answers sent to you.

Occasionally, I will suspend forum discussion for some assignment requirements in which the value lies in discovering how to solve the problem independently.

Employers often find the forum to be a good place to solicit new hires. Only principals may post messages for their companies, subject to the following parameters:

- NO SPAM
- Name and location of your company
- Type of product made
- Position description and requirements

HEADHUNTING WILL RESULT IN IMMEDIATE AND PERMANENT EXPULSION FROM THE FORUM

This forum is my own private property; therefore, freedom of speech does not apply to any posted content. Anyone whose actions are, in my sole and absolute judgment, detrimental to the forum will be removed without warning or appeal.

Lectures videos

Lecture videos, along with all sample code and slide decks, are typically available on the course web site about 1-3 days after each class. If you are unable to attend the actual class, I strongly advise you to view its video as soon as possible.
Lectures

1 - JANUARY 29, 2015
Instructor and TA introductions
Course & Syllabus overview
Azure overview Part I
Azure Mobile Services – Part I
Assignment #1 Assigned - Due February 12, 2015 at 5:00 PM EST

2 - FEBRUARY 5, 2015
Azure overview Part II
Azure Mobile Services – Part II
Azure SQL Fundamentals

3 - FEBRUARY 12, 2015
Azure Mobile Services – Part II Continued...
Assignment #2 Assigned – Due February 26, 2015 at 5:00 PM EST

4 - FEBRUARY 19, 2015
Azure Mobile Services Part III
Authentication Fundamentals
Final Project Requirements Overview

5 - FEBRUARY 26, 2015
REST Fundamentals
Scalable REST Services
ASP.NET Web API in Azure – Part I
Assignment #3 Assigned - Due March 12, 2015 at 5:00 PM EST

6 – MARCH 5, 2015
ASP.NET Web API in Azure – Part II
Azure SQL – Part II

7 - MARCH 12, 2015
Azure Notification Hubs
Web Jobs

MARCH 19, 2015
Spring Vacation – No Class Held

8 – MARCH 26, 2015
Azure Storage
Functional Specification Due at 5:00 PM EST
9 - APRIL 2, 2015
Azure Active Directory
  Authentication & Multi-Factor support
  Authorization
Azure Web Sites

10 - APRIL 9, 2015
Azure Tables and Queues
Worker Roles

11 - APRIL 16, 2015
Azure Caching Services
Azure DocumentDB
Design Specification Due at 5:00 PM EST

12 - APRIL 23, 2015
Azure Event Hubs
Azure HDInsite

13 – APRIL 30, 2015
Guest Lecture by Author & Professor David Platt
User Experience http://www.rollthunder.com/

14 - MAY 7, 2015
Azure API Management
Azure Search

15 - MAY 14, 2015
Final Project Student Presentations
Final Project Implementation Due at 5:00 PM EST
Sections
Sections are intended to provide a face to face forum for students to get assistance with their homework, get answers to questions related to course related topics, and provide supplemental course material. The following is a list dates of when section will be held.

Note: Additional lecture topics will be added based on the needs of the class and TA availability.

JANUARY 29, 2015
First night of class – No section held

FEBRUARY 5, 2015
Lecture Q & A
Homework Q & A

FEBRUARY 12, 2015
Lecture Q & A
Homework Q & A

FEBRUARY 19, 2015
Lecture Q & A
Homework Q & A

FEBRUARY 26, 2015
Lecture Q & A
Homework Q & A

MARCH 5, 2015
Lecture Q & A
Homework Q & A

MARCH 12, 2015
Lecture Q & A
Homework Q & A

MARCH 19, 2015
Spring vacation – No class held

MARCH 26, 2015
Lecture Q & A
Homework Q & A
Sections continued...

**APRIL 2, 2015**
Lecture Q & A  
Homework Q & A

**APRIL 9, 2015**
Lecture Q & A  
Homework Q & A

**APRIL 16, 2015**
Lecture Q & A  
Homework Q & A

**APRIL 23, 2015**
Lecture Q & A  
Homework Q & A

**APRIL 30, 2015**
Lecture Q & A  
Homework Q & A

**MAY 7, 2015**
Lecture Q & A  
Homework Q & A

**MAY 14, 2015**
Lecture Q & A  
Homework Q & A