Final Project
CSCI E-64
Mobile & Cloud Computing

The final project is an opportunity for you to dig into the material provided in lecture that is of particular interest to you. You should plan on spending a minimum of **80 hours** on your final. The median student should expect that the final project will take approximately **115 hours**. The final project is worth **60%** of you overall grade.

Be careful to scope your project to be completed in the allotted time. The largest downfall students typically have is creating a project that is too large. Get the base requirements satisfied, and then add the frills. Please consult your TAs for guidance on the scope and content of your final

There will be **no-extensions** provided for the final project. **All** final projects are due at **5:00 PM EST on May 12, 2016.**

Your final project must be an individual effort; you may not submit a project worked on jointly with other students or other co-workers.

You may collaborate with other students to workout issues you run into but you may not share code with other students nor include their code in your project.

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Final Project Core Requirements

Your final project **must** incorporate the following:

1. Azure Mobile App Services and/or ASP.NET Web API using Azure API Apps
    a. Be sure to describe why you choose one or the other or both
2. Azure SQL
3. REST Interfaces
    a. Must be used for all Azure hosted services you create
    b. Must not be state-full such that you require the caller to contact the same compute node
4. Authentication
    a. Shall be supported using one or more of the following
        i. Microsoft Account
        ii. Facebook
        iii. Twitter
        iv. Google
        v. Windows Azure Active Directory
5. Authorization
    a. You must have roles that control
        i. Access to certain functions and REST interfaces
        ii. Visibility of specific UI elements
    b. You must have at least two roles
        i. Admin Role
        Access for administrative functionality
        (Approving self-service user enrollment for example)
        ii. User Role
        Standard user functionality
        (Adding a stock to monitor for example)
6. Azure Web Jobs
7. Azure Blob or Azure File Storage
8. Secure Services
    a. SQL Injection attacks
    b. Un-authenticated access to costly resources
9. Azure Mobile Client Application(s) for one of the following platforms
    a. Universal App using C#
        i. Can be a Desktop, Phone, Tablet or Raspberry Pi 2 IoT core app
    b. Android App using Xamarin and C#
    c. iOS App using Xamarin and C#
10. Unit tests for ALL
    a. REST Services you create

Electives

Your final project **must** also include **three** of the following elective technologies:

1. Azure Tables
2. Azure Queues
3. Azure Redis Cache
4. Azure Document DB
5. Azure Notification Hubs
6. Azure Worker Roles
7. Azure Event Hubs
8. Azure IoT Hub
9. Azure API Management
10. Azure Search
11. Azure Websites

Your final project implementation is worth **80% of your final project grade.**

Extra Credit

You may choose up to two additional electives for extra credit. Each elective you add, up to two max, has the potential to earn up to 7 points of extra credit each on your final project implementation.

For example, let's say you implement 5 electives. You have the potential to receive 14 points of extra credit on your final project implementation grade. If you receive a perfect score on your final project implementation, design specification, functional specification and all of the extra credit you would receive a 111 for a score on your final project grade.

Functional Specification

You will be required to provide a **functional specification** for your final project to your TA by **March 31st, 2016**.

Your TA must approve the **functional specification** so I strongly recommend that you submit a draft to your TA as early as possible. You may submit multiple drafts to the TA for review. The functional specification will be worth **10% of your final project grade.**

Design Specification

You will be required to submit a **design specification** by **April 21st, 2016**. Your TA must approve the design specification. Again, I strongly recommend that you submit a draft to your TA as early as possible. You may submit multiple drafts to the TA for review. The design specification will be worth **10% of your final project grade**.

Functional & Design Specifications Guidelines

Functional and Design specifications mean many different things to many different people. Here are some guidelines for what functional and design specifications shall be in this project.

The functional specification shall contain a detailed description of what your project will do, and what functionality it will provide. It will also, at a very high level, show a mapping between the requirements and the functionality. The functional specification shall include functional artifacts to communicate what your project is and does. Some examples are: screen mockups, workflows, use cases, and a navigation / site map of your client application workflow(s).

Below is one possible mapping of a requirement to a piece of functionality:

> *The user will be notified when a stock drops below a specified value through a push notification. Azure Notification Hubs will be used to notify the mobile application of the stock price change.*

The design specification shall contain a detailed description of how your project will do what you have specified in the functional specification. The design specification shall contain class diagram(s) (you can use UML if you are so inclined), sequence diagrams as well as high level architectural block diagram(s). You may include other diagrams if you wish to better communicate the design.

One of the most important parts of any design specification is the why. Why did you choose to use a Web Jobs for example? Why did you choose to cache a particular item in distributed cache? Your design shall include the descriptions of why you choose to design key or critical aspects of your project the way you did.

User Documentation

You must provide **documentation** that will instruct the user as how to use your product. (I.e. If the TA can't figure out how to run it or operate it, you will not receive a very good grade)

Documentation scope

Although at first glance you may think the functional specification, design and user documentation documents might have to be 30-50 pages, however that is not the case. The main purpose of the documents is to make sure **you** and the **TA** understand what you are building. This will help you and the TA to be sure that what you are attempting to build is doable, in the time frame given, and that it meets requirements specified.

Demonstration

You are required to demonstrate your mobile and cloud applications full functionality to the TA and optionally to the class.

If you choose to demonstrate your application to the class, you will receive 5 points extra credit on your final project grade and be entered into a contest with your peers. There are 1st, 2nd and 3rd place prices. In class demonstrations / recorded or live shall be limited to 5 minutes.

Awards will be determined by a tally of votes at the end of the class by the teaching staff and your classmates.

If you are remote you may record your project demo so it can be played back for the in-class demo. If you choose to record your demo for inclusion into the contest you must complete the recording by **May 10, 2016 at 5:00 PM EST** and notify the TA and me (Joe Ficara) that you have created a recording for submission.

Contestant instructions:

1. Signup as a contestant on the sections page (there will be a sign up for final project contestants)

2. If you are going to perform a recorded submission, you must submit the recording by **May 10, 2016 at 5:00 PM EST**
    a. Send an email to me (Joe Ficara) and your TA so we know that you are going to record your final project for the contest
    b. If using the Canvas Conference for your recording:
        i. Coordinate with a TA so they can setup the session so you can record your demonstration.
    c. For all recordings be sure to show the following on your screen at the beginning of the recording
        i. The course number and title
            1. E.g. CSCI-E64 Mobile & Cloud Computing
        ii. Your name
        iii. The title of your final project
    d. If you wish to use a different method to record your demo, just upload your recording to the final project drop box.
        i. Be sure to let the TA and Joe Ficara know that you uploaded your video to the final project drop box
        ii. Use an MP4, WMV, Quicktime or Flash recording format or we may not be able to play it
        iii. You can also upload your recording to YouTube just be sure to include the URL in your Email to your TA and myself (Joe Ficara)

Your final project TA assignment will be provided to you via email by within the first few weeks of class.

Important - Credential Requirements

1. The Azure services you create must be installed and running on your Azure account
2. Your mobile application(s) must be configured to access your Azure account's services.
3. You must provide the TA with all credentials needed to access your services including:
    a. Keys
    b. User IDs and Passwords
    c. How you have mapped user ID's to roles
        i. E.g. The TA should know that:
            1. User ID: bart_g maps to an Admin role
            2. What the Admin role is capable of doing
4. The TA does not need access to your azure account
    a. Don't provide the TA with your Azure account credentials
5. The TA needs full access to the public functionality of the services you created including all credentials needed to properly authenticate with them and exercise their full functionality.

Client Application Requirements

The client application can be one of the following:

1. Android
    a. Visual Studio or Xamarin Studio with Xamarin and C#
2. iOS
    a. Visual Studio or Xamarin Studio with Xamarin and C#
3. Windows Universal App
    a. Using C# and the Universal app template
4. Windows IoT using the Raspberry PI 2
    a. Using C# the Universal app template
    b. If you use other sensors or hardware you must provide that to the TA in order for them to test your app. They will have a Raspberry Pi 2 along with the Astro Pi Sense Hat.
    c. The TA shall not be required to build any circuits in order to test your app

In all cases you must not use the pre-built samples available for download from the Azure Dashboard / Website, etc…

Getting early feedback

You may submit your final to your TA **earlier**. This is **strongly recommended**, as your TA will be able to give you feedback **without a grading penalty**. If you incorporate all of the feedback provided by your TA into your final it should be possible for you to achieve an excellent grade.

Final project scope and due date

The scope of your project should be on the order of 7 homework assignments.

Your final project will be due at **5:00 PM EST on May 12, 2016**. The final project must include the functional specification, design specification, instructions for installing/running and operating your application and the full implementation.

The final project deliverable must include all code, including Microsoft Azure service code, mobile client code, scripts/code to pre-populate Azure database(s) with sample data, and files necessary to deploy your Microsoft Azure services and run your mobile applications. You do not need include the publisher profile files used to publish your mobile app or other service to Azure from Visual Studio.

Final Project Ideas

1. A stock trading application.
2. An internet store
3. A movie rental store
4. A social network website
5. A dating application
6. A multi-player game
7. An auction facility like eBay, on a smaller scale of course
8. A project for work
    a. If you do this, you must complete the entire portion yourself **(No team effort here).**
    b. You must be able to submit the entire code base of your project to your TA with the understanding **that it is free-ware**.
    c. You can maintain no intellectual property associated with the work you turn in.
    d. The TAs will not be signing NDAs or any other legal documents.
    e. Finally the TA must be able to
        i. Run the mobile application on their own hardware
        ii. Deploy the services you created to their Azure account if necessary
        iii. Utilize the Azure services on your academic Azure account
        iv. Build, run and fully exercise your project without requiring any additional hardware, third party products or licenses.

Final thoughts

Some of you are bound to look at this final as something that will be painful. It will be a lot of work but it may be one of the few opportunities you will have to build something that you want to build. The end result will be something you can bring to potential employers to show them you know your Microsoft Azure and mobile development stuff! Who knows, you could even enhance the project and market it!