Take-home Midterm

Please bring a printed copy of your answers to class Thursday March 2. You may not collaborate or interact with your classmates or anyone else AT ALL. You may consult only myself and access material on the class website, your notes, anything mentioned in this exam, and within the papers we’ve read. No other sources (incl. Internet sources) or other papers are permitted. The total solution length should be in the 3-5 page range and appear as a professional formatted document. Do not forget to put your name on it. You may check the Announcements part of the class web page for any clarifications during the exam window.

1. **Placement:** A number of papers have presented architectures for the deployment of edge functions (e.g. AirBox and Paradrop, among others). Suppose there are a large number of sensors as well as a large set of edge nodes. How would you select an edge resource to run a particular edge function (i.e. the placement of the edge function)? What factors should be considered and why?

   **Factors:** proximity/locality, load balancing across the edge resources, privacy/security, resource affinities/heterogeneities

2. **Sensing:** We have read a few sensing papers including FocusStack. One of the difficulties with remote sensing is how to ensure that the sensed data is correct, that is, it represents a true measurement. For example, how can the application be certain the data it is seeing represents the true sensor reading as opposed to some fake data provided by a compromised sensor? Describe how you might design a solution to this problem. Present the pros and cons of your approach.

   **Best answer:** Replication (acquire data from nearby but different sensors and vote the majority)
   **OK answer:** anomaly detection, consider legal range of values (may be hard for video sensing), encryption to prevent data tampering, use secure hardware

3. **Privacy:** Compare and contrast the privacy approaches in the GDP (Berkeley) and the PM (Privacy Mediators) papers. How are they different? How are they similar? Pick an example scenario that is best solved using PM and one that is best solved using GDP.

   **GDP:** focus is on sharing across applications, time series data, and persistence of data
   **Example:** application wishes to do trend analysis on sensor data

   **PM:** focus is on user control, filtering/screening of data at the source
   **Example:** user photographs, screening images of kids, before sending out

4. **Reviewer:** The following paper: [http://www-users.cselabs.umn.edu/classes/Spring-2017/csci8980/papers/EdgeArch/furnace.pdf](http://www-users.cselabs.umn.edu/classes/Spring-2017/csci8980/papers/EdgeArch/furnace.pdf) has just been submitted to a conference. Create a review of this paper. Provide a brief one paragraph overview the problem and comment on its strengths and weaknesses AS a reviewer in your own words.

   Any focus on scientific strengths and weaknesses was accepted.
5. **Debunk This:** Edge computing is nothing new. It is a re-hash of Grid, P2P, cloud, etc. By drawing on supporting examples and systems from the papers read in the class, argue that indeed Edge Computing has a new and unique set of challenges. **Best answers:** weak power of far edge devices, strict latency requirements, data privacy, dynamic and/or mobile environment, energy constraints, heterogeneity of edge devices

6. **IoT:** There are two classes of ‘things’; those that produce data (e.g. a sensor) and those can be actuated to do something (e.g. a camera that can be remotely turned). Of course, some things can do both. We’ve read numerous papers that describe how the edge can benefit applications that require access to data collected at the edge or far edge. Describe how the edge can benefit applications that wish to actuate devices. **Best answers:** proximity -> lower latency to actuate devices with tight time bounds, security -> only trusted attached edge device should be allowed to actuate, sharing -> edge device can mediate shared access to the IoT device