Data Management for The Internet of Things: Literature for Students

(Assembled by Iluju Kiringa and Tet Yeap)

(THE LIST WILL BE CONSTANTLY UPDATED)

INTRODUCTORY NOTE

This is a comprehensive list of articles and books that are of help for the students working on IoT subjects in our IoT Lab. Anyone who is starting should read ALL the references highlighted in RED. Then talk to Professor Iluju Kiringa and Tet Yeap for further reading to chose a thesis or a project topic. If anyone finds an interesting paper or book on the subject matter, please let us know so that we include it into this reading list.

Cyber-Physical Systems (CPSs) are smart real-time systems that find a growing number of applications that span diverse domains encompassing agriculture (smart farming), transportation (smart asset management), housing (smart buildings), health care (smart e-health), and infrastructure (smart power grids). All these applications have in common the increasing use of the Internet of Things (IoT) to monitor operations in order to achieve the goal of reducing overall operating costs and making real-time data about the monitored entities accessible. IoT is a paradigm of networking where the networked points (called “things”) comprise uniquely identifiable devices equipped with embedded connectivity.

Consider the following use case related to *La Société de transport de l’Outaouais*, the urban transit company servicing Gatineau, a metropolitan area facing the city of Ottawa, which has carried 20 million riders in year 2016. The company runs an integrated set of services such as (1) regular buses travelling either on fixed routes in normal urban traffic or as high frequency services on a separated network of dedicated bus lanes and ways, and (2) several bus stations with Park-and-Ride facilities to smooth connection between bus and car rides. STO intends to reduce operating costs by improving efficiency, overall utilization of the fleet. STO also wants to put real-time fleet management at the disposal of the company decision makers to achieve the desired levels of cost reductions by tracking their buses and bus stations as well as operational data produced by those assets in real time. This allows, for example, the decision makers to remotely monitor the whereabouts and the state of their busses by using applications (either on desktops or on mobile devices) that consume the aforementioned operational data. Finally, STO wants to continuously monitor each one of its rolling assets to avoid unnecessary prescheduled maintenance unavailability.

To achieve their stated goals, STO may equip every bus and station with an IoT gateway. On one side, the gateway is mounted on the top of the bus or the station and is connected directly to cloud-servers, and on the other side, it is connected to appropriate sensors to monitor variables of interest. The gateway periodically collects sensor readings to detect events of interest, stores the events, and periodically sends the stored events to a proprietary cloud-based IoT software platform. The later can then be processed by analytics applications and be accessed from front-end devices to track assets in real time, monitor bus drivers' state, alert deciders of abnormal asset states, monitor excessive idle time, and monitor full stations to divert buses to them.

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ARCHITECTURE

Note: Everyone should also read the technical report on our own architecture that is in the common Goggle Drive.

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USEFUL WEB LINKS

Data Models and Realtime DBMSs for both the Edge and the Cloud

GTFS data format: http://www.gtfs.org/
GTFS-RT data format: https://developers.google.com/transit/gtfs-realtime/
GTFS / GTFS-RT feeds from around the world: https://transitfeeds.com/
GTFS-RT tutorials: https://support.google.com/transitpartners/answer/2529244?hl=en
extremeDB : http://www.mcobject.com/?PMC=HP
SQLite: http://www.sqlite.org/
Apache Cassandra: https://cassandra.apache.org/
MongoDB : https://www.mongodb.com/

Protocols

MQTT: http://mqtt.org/
J1939: http://www.sae.org/standardsdev/groundvehicle/j1939a.htm
J1939 simulator and documentation:
http://copperhilltech.com/sae-j1939-ecu-simulator-board-with-usb-port/
Connecting to J1939 board with Rasbery Pi:
http://copperhilltech.com/blog/sae-j1939-ecu-simulator-and-data-monitor-for-raspberry-pi/
WiFi: https://www.wi-fi.org/
LTE: http://lteworld.org/

Platforms

GE Predix IoT Platform: https://www.predix.io/
Amazon Web Services for IoT: https://aws.amazon.com/iot/
Microsoft Azure Platform: https://azure.microsoft.com/en-us/
Google Cloud IoT: https://cloud.google.com/solutions/iot/
IBM Bluemix Cloud: https://www.ibm.com/cloud-computing/bluemix/
Cloud Forge: http://www.cloudforge.com/

Use Cases

Libelium Consortium: http://www.libelium.com/
Intel IoT Case Studies:
https://www.iotone.com/vendor/intel-inside-intel/casestudies/v903