Introduction

Lecture 1 for Information Processing

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Introduction - Myself

My name is Aaron, and my research looks at the intersections between algorithm, hardware and security in Deep Learning (DL) Systems. My email is a.zhao@imperial.ac.uk, and my office is 903.

Introduction - Myself

- How do novel hardware architectures improve the efficiency of running ML workloads?
- How to tweak current ML algorithms to make them more efficient on today and future hardware systems?
- ML security related topics with a hardware spin.

Introduction - People

The course is taught by me and Sarim Baig:

- I cover the FPGA parts
- Sarim covers the AWS parts

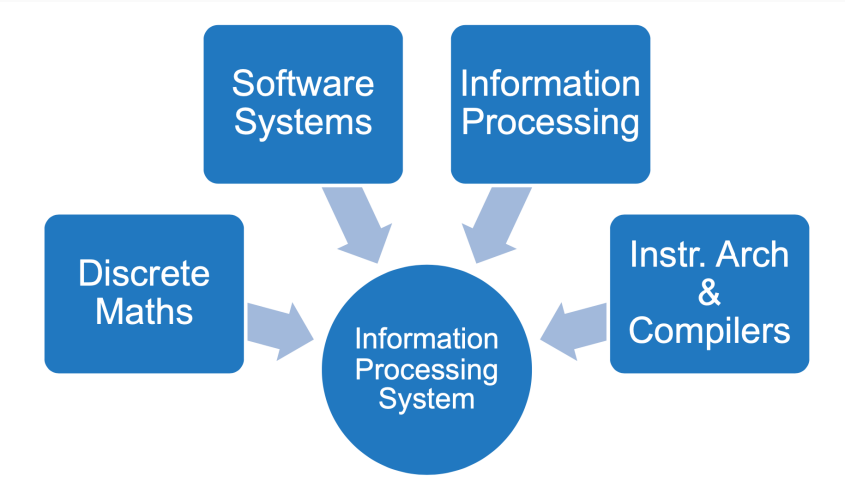
Introduction - Where to find stuff?

Everything is online

- The course webpage (`https://aaron-zhao123.github.io/teaching/info_eng`)
- The Labs (1-4) are in a Github Repository (`https://github.com/Aaron-Zhao123/ELEC50009`)
  - Do not push to this repository.
  - Fork it.
- If you do not understand what is push and fork, check this link: `https://www.youtube.com/watch?v=nT8KGYVurIU&ab_channel=TheCodex`

Objectives and delivery

- Bring together theory and application from other modules
- Create an information processing system
- Project-based learning and integration of knowledge

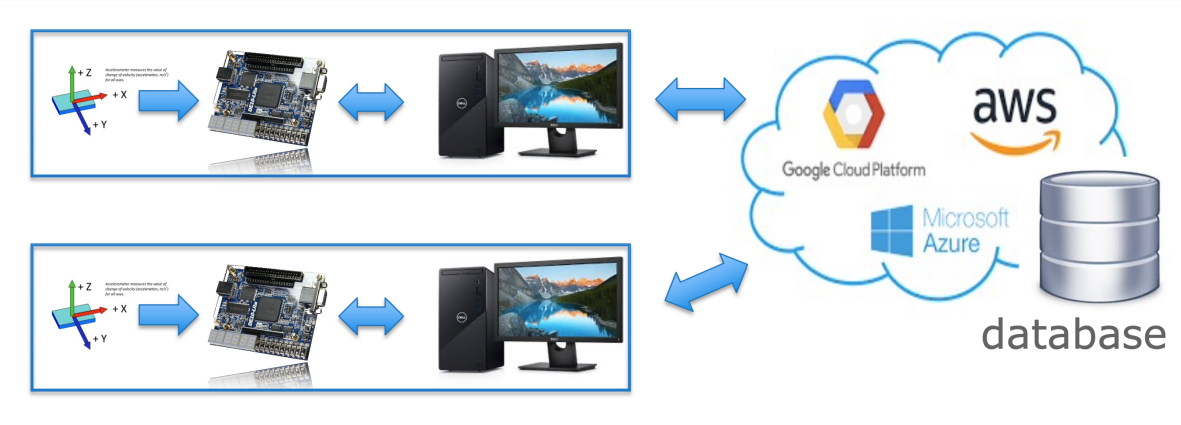


Intended Learning Outcomes

- Design an information processing system that captures, analyses, manages, and outputs signals
- Implement an information processing system using a combination of software, hardware, networks, and databases
- Optimise a system to achieve given performance or quality targets

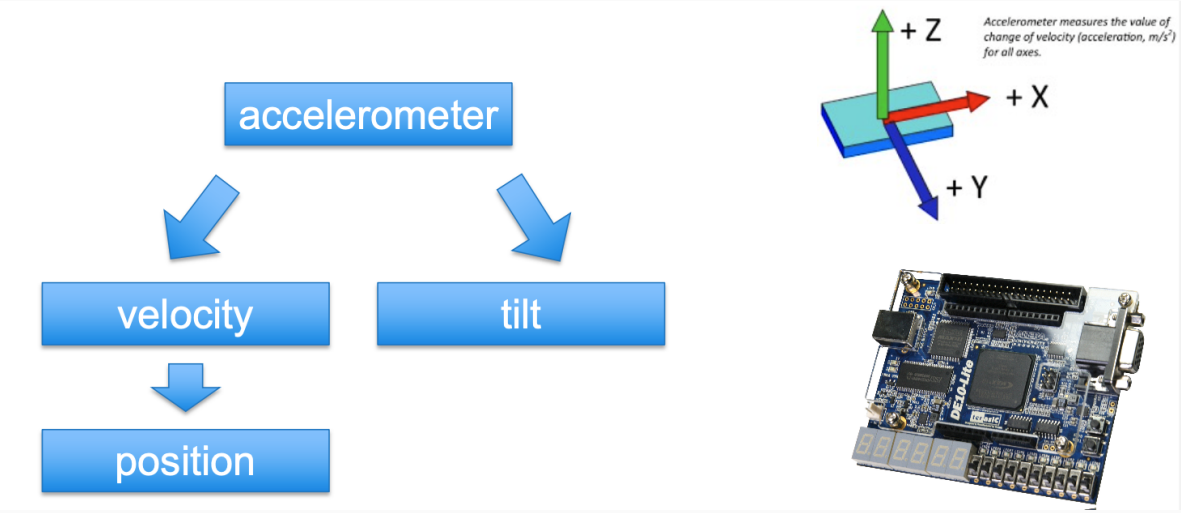
Let's be more specific: Design an IoT system

- Nodes for local (signal) processing of accelerometer data
- Communication to a server
- Integration with a database
- Adapt processing in nodes



Let's be more specific: Accelerometer

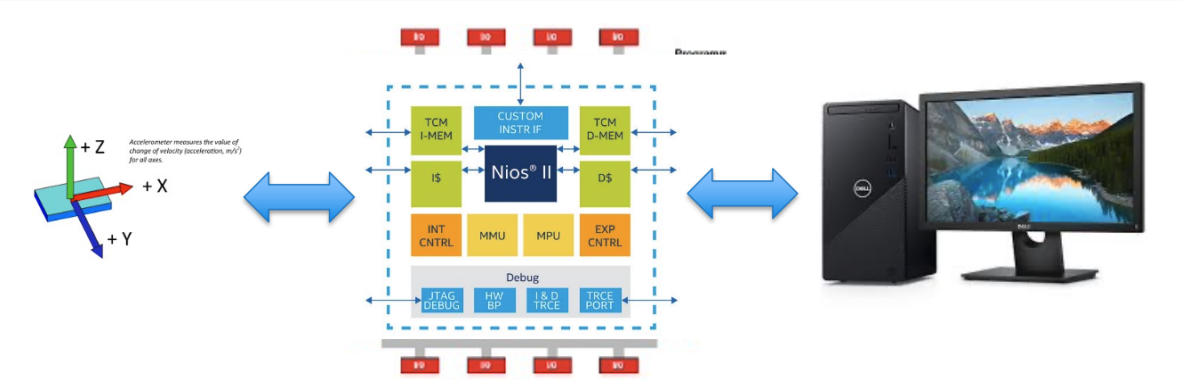
Accelerometer measures the value of change of velocity (acceleration)



Let's be more specific: The Development Board

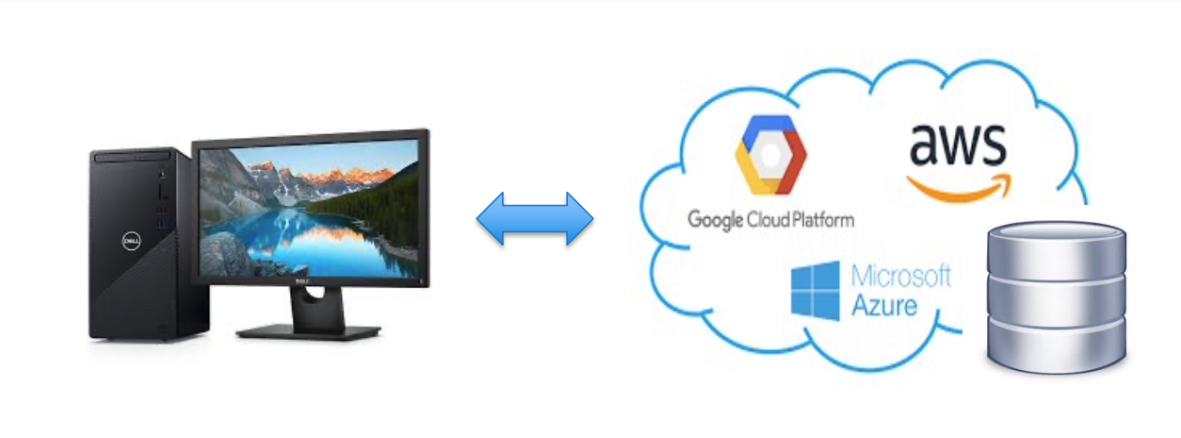
DE10-lite

- FPGA (Intel)
- Instantiation of a soft processor (NIOSII)
- Processing capability (can perform computation) and communication capability (talk to a local PC)



Let's be more specific: AWS DB

- Instantiate and use a database on the cloud
- Communicate from the host PC to the database through network



Structure and dates

- Phase 1 - training (Week 2 - Week 5)
  - Lab based
  - To help you to build an understanding of the system
  - with GTAs for Q&A
- Mid-term Assessment (20%) (Week 6)
  - Lab orals
  - Completion and understanding of the labs
- Phase 2 - group project (Week 7 - Week 10)
  - Functional requirements
  - Non-functional requirements
  - We offer Book an Expert help hours
- Final Assessment (80%) (Week 11)

Phase 1 - Training

- Week 2 (Aaron)
  - Lab 1: Introduction to DE10-Lite. Install tools and learn how to program the device
  - Lab 2: Instantiate a NIOSII system, use the accelerometer
- Week 3 (Aaron)
  - Lab 3: Establish a UART-base communication between the board and the PC
  - Lab 4: Design an IP module for performing a moving average in HW. Connect to NIOSII and process the accelerometer data
- Week 4 (Sarim)
  - Lab 5: Create a remote server in AWS and run a custom service
- Week 5 (Sarim)
  - Lab 6: Create a remote database and perform queries

Phase 2 - Coursework

- In-person and remote working support
- General idea
  - Local node needs to talk to a server (on the cloud).
  - Server needs to talk back, the information needs to propagate back.
- Elaboration
  - Try to see how nodes can affect each other.
  - Detect events, and change the processing in the nodes through a centralised server.
  - Log your events, or perform action on the events.
- Detailed functional and non-functional requirements will be communicated

Logistics

- Lectures (Every Monday Weeks 1-5, then in ad-hoc basis as needed)
- Weekly support hours for the Coursework (10min slots).
  - Prepare your questions
  - Book a slot
- Groups and Communications
  - Groups of six, have to all come from either group A or B.
  - Private channel on Teams (I will make them)
  - If you cannot find a group, we will make one for you
- Course Material
  - Teams
  - Coursework wiki and Github for FPGA related labs

Logistics

- Install tools
  - Virtulbox.
  - Or natively, but make sure you have the right version
  - Or lab machines
- Lab starts tomorrow
- What do I do next?
  - Form a group, declare your group, pick up a board from STORES.
- Any questions?