

# COL788 Advanced Topics in Embedded Computing

Systems Software in Embedded Platforms

# System software is everywhere

We focus on embedded platforms, but the hardware architecture is similar across platforms

# Challenges of working in this domain

- High variation in details of each hardware component in a platform, though the overall architecture is similar
  - each new embedded platform will come with a board support package (BSP)
  - each new device in a platform will come with its own device driver

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  - especially for embedded linux, a monolithic kernel
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- Application requirements vary
  - Latency, energy, even within latency there are different classes

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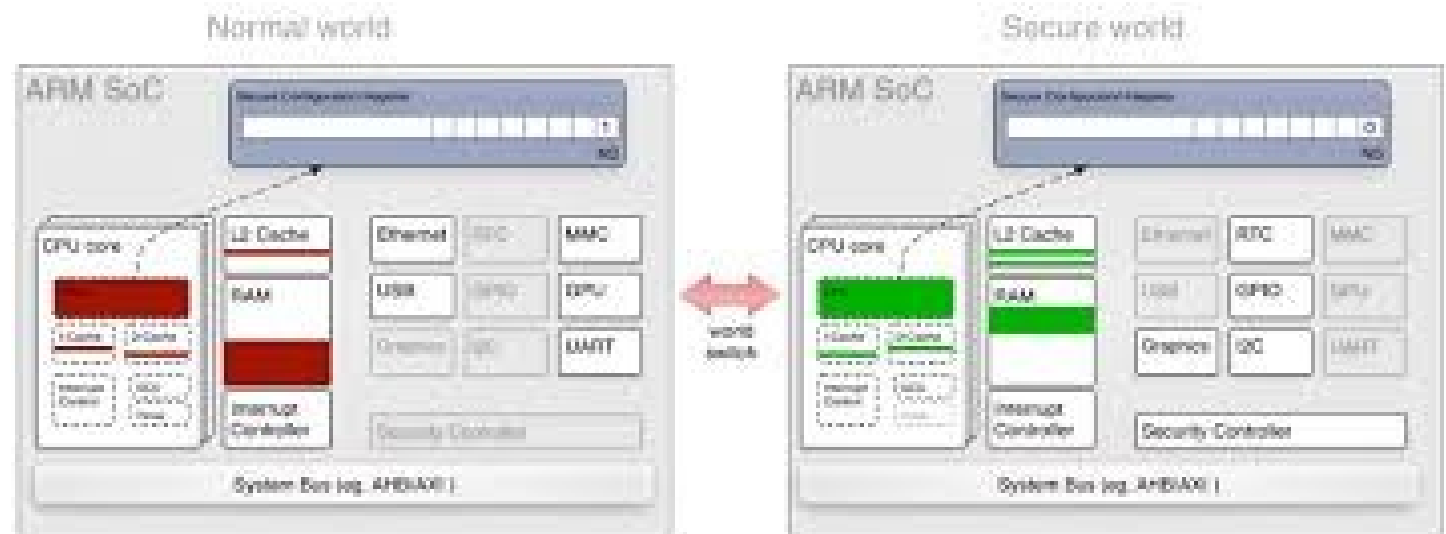
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- Hardware devices is an evolving domain
  - New sensors
  - New radio technologies
  - .....
- Computer architecture is an evolving domain
  - Computational accelerators
  - Security accelerators
  - .....
- Application software is an evolving domain
  - DNN based applications
  - Security applications
  - ...



# An example from my recent work

- "SeClaok: ARM Trustzone-based Mobile Peripheral Control", Matthew Lentz, Rijurekha Sen, Peter Druschel and Bobby Bhattacharjee in Mobisys 2018
- Follow up work on authentication and encryption



# Course plan

- Bootloader – **assignment (5)**
- Embedded linux kernel
  - Processes and threads – **assignment (5)**
  - Memory/filesystem
- Device drivers – **assignment (15)**
- Scheduling, including real time – **two assignments (30)**
- Wireless radios and networking
- Security, verification
- Specialized embedded system software: Arduino, contiki, tinyos, RTOS ...
- Recent research papers: student presentation **(5)**
- An end to end project - **(20)**
  - Bonsai with sensor inputs on arduino
  - CNN performance with different kernel schedulers on Raspberry PI
  - .....
- Major exam **(20)**

# Course calendar

Mon	Tue	Wed	Thu	Fri	Sat	Sun	topic	
23	24	25	26	27	28	29	bootloader	
30	31	1	2	3	4	5	processes, threads	5+5+15
6	7	8	9	10	11	12	linux device tree, device drivers	
13	14	15	16	17	18	19	linux device tree, device drivers	
20	21	22	23	24	25	26	minor1 week, Riju giving talk at SIGCOMM	
27	28	29	30	31	1	2	memory/filesystem	
3	4	5	6	7	8	9	scheduling, real time	15+15
10	11	12	13	14	15	16	scheduling, real time	
17	18	19	20	21	22	23	scheduling, real time	
24	25	26	27	28	29	30	networking, communications	
1	2	3	4	5	6	7	minor2 week	
8	9	10	11	12	13	14	arduino, contiki, tinyOS, RTOS	
15	16	17	18	19	20	21	fest, midsem break	
22	23	24	25	26	27	28	student presentations, project	
29	30	31	1	2	3	4	student presentations, project	5+20
5	6	7	8	9	10	11	diwali	
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Hardware logistics .... based on #students