Assignment 0
RTOS Survey
RTS 2020-2021 (IN4343)

1. Introduction

The objective of this assignment is to learn about Real-Time Operating Systems (RTOSs) by investigating its features and architecture. The output of the assignment is a survey report (in a written format) and a short presentation. You can investigate one of the following RTOSs:

- **RTEMS** (it used in avionics, is open source, and is widely supported by the real-time systems community)
- **Preempt-RT** (it is the result of the efforts of Giorgio Buttazzo's team that has opened up its way to the Linux community)
- **FreeRTOS** (it is extensively used in embedded system domains with latency-sensitive systems, however, has only limited support for real-time scheduling policies, etc.)
- **VxWorks** (It is commercially used in many systems like Lithography machines where systems have hard timing constraints.)
- **ERIKA** (this RTOS is specialized to run automotive applications and is compliant with Autosar)
- **μC/OS-II or μC/OS-III** (This RTOS is also commercially used. This RTOS is compatible with not only hard chip based processors but also soft processors like NIOS-II. Soft Processors are developed using hardware descriptive languages over FPGAs etc.)
- **NuttX**
- **RT-Linux**
- **Pike-OS**
- **An RTOS of your choice (not in the list)** For this item, you need to get a confirmation from the TA.

2. Survey's content

A. High-level introduction to the following:
    1. Kernel Architecture
    2. Task Creation
    3. Types of supported tasks and the code structure or the mechanism to create those tasks (for example, how to make periodic or sporadic tasks). Does the RTOS provide explicit mechanisms to define a periodic task or it is left for the programmer to ensure that a task is periodic?
    4. Where are the drivers (kernel space, user space, etc.) and how a new driver can be added to the RTOS?

B. What scheduling policies are provided/supported by the RTOS? How are they implemented?

C. Are there possibilities for tracing and debugging the kernel? Are there tools and environments to analyze or visualize such traces?

D. What mechanisms does the RTOS provide to support mutual exclusion (e.g., semaphores, Mutex, etc.)

3. Instructions and deadlines

To avoid having too many teams that survey the same RTOS, **you need to get a confirmation about the RTOS you want to investigate from the TA**. This step must happen through **Brightspace** ("RTOS survey selection/confirmation"). The confirmation will be sent in a first-come-first-serve manner.

Deliverables

- **Final report:**
  - Your report should be maximum 6 pages (PDF format) unless you need to add a lot of figures.
  - It must be understandable by general audience who know about the concepts of realtime systems but does not know anything about the RTOS you investigate.
  - You must upload your final report on **Brightspace.**

- **Presentation:**
  - Each presentation is about 10 minutes.
  - It should introduce the RTOS, its features, and show how to use it (don't forget to include answers to the questions in Section 2).
  - You do not need to have a **live demo** during your presentation.
  - You must upload your presentation (**well before** the presentation session) on **Brightspace**.

- **Extra materials:**
  - If you present a live demo, you need to upload the codes and materials required for the demo on **Brightspace** together with your report.
  - There should be an explanation of any step that is needed to make the RTOS run on the example.
  - If the RTOS can only be built by custom build tools, then also mention the build tool installation steps as well as the steps to compile the RTOS example.

Hints: make sure the report is understandable by your peers (i.e., you can assume the reader to have followed the course), refer to relevant related work when applicable, include ample figures, have a peer proofread the text, preferably more than one hour before the deadline :-).

Grading rubric.

- The quality, thoroughness, and depth of the survey: 40%
- Quality of the report (readability, structure, presentation of materials): 30%
- Quality of presentation: 30%

Deadlines.

- **RTOS survey report deadline**: March 26th 2021 (23:59pm)
- **RTOS survey presentation day**: March 26th 2021 (13:45 to 18:45)

Please upload your report by the **26th of March on Brightspace**.