

**Project WEB-DMDL: Web Based Development of  
Decomposite MAC Description Language (course: ID2205)**  
Supporting fast development of communication protocols on Software  
Defined Radios

Due to the booming in wireless technologies and the new emerging application scenarios, Consequently, early prototyping and quick proof of concepts are becoming the keys to develop the next generation communication systems. Software defined radios has been drawn a lot of attention due to its flexibility and convenience in design and development new protocols without costly device replacement. Currently, there are a number of tools existing that can help developers to carry out their work on SDRs, however, most of them are still focus on a specific platform and the main focus is on PHY layer and signal processing. Therefore, Decomposite MAC Description Language (DMDL) is proposed as a unified framework for easier MAC protocol design and prototyping [WaPM18]. It conceptually modeled as a hierarchical finite state machine. MAC functionalities are decomposed by comprehensively reviewing existing MAC schemes and predicting future demands. DMDL has been implemented in GNU Radio and used in both RWTH Aachen University and KTH as the tools in research and teaching.

In this project, the student will first get in touch with the fundamental knowledge of SDR development and DMDL. Then the student is supposed to develop a light weighted web-based interface for DMDL which enables users to carry out protocol design and briefly perform the syntax check. It is not required for the student to develop the full toolchain from the web to the SDR hardware, however, since it is part of the big project with the final goal to enable developers to perform remote prototyping and direct access to the SDR hardware, a will documented manual and thoughtful API design is important.

**Required Knowledge:** JavaScript, CSS and HTML

**Contents**

Project WEB-DMDL: Web Based Development of Decomposite MAC Description Language (course: ID2205) ..... 1

Project requirements.....2

Phase 1: Block Design.....3

    Additional resources.....3

    Completion criteria .....3

Phase 2: Connection Design .....3

    Completion criteria .....3

Phase 3: Syntax Check .....3

    Completion criteria .....3

Summary of Deliverables.....4

Reading Materials .....4

## Project requirements

This project is comprised of the following tasks:

1. Develop the GUI and ICON for all blocks defined in DMDL. **(15%)**
  - Following the block definition in (1), develop the mechanism of changing the appearance of the block according to the options which users can configure in design. **(10%)**
  - Develop the mechanism that users can allocate the blocks in any place of the canvas freely. **(5%)**
2. Develop the block connections. **(15%)**
  - Define ports of blocks according to the DMDL definition. **(5%)**
  - Develop the mechanism that ports can be connected by the clicks from the user which are the typical behaviors as some of the flow graph software like Visio or GNU Radio. The connection should be kept even the blocks are moved around. **(10%)**
3. Develop the front panel of blocks which has some drop-down type of interface that users can configure the block or input some data. **(20%)**
4. Develop the internal structure of the block to indicate that which information is needed. For instance, the sending block requires the MAC frame and the radio parameters. **(20%)**
5. Develop the mechanism to check the designed graph according to the MAC protocols rules. **(20%)**
  - Create the structure inside block, in which can store the configuration or information that generated by users from the front panel. **(5%)**
  - Add functional buttons for users to start the check and debugging process. **(5%)**
  - Check the whole block chain in the order of connections to see that whether the needed information of a block is already generated by the former ones. **(5%)**
  - Develop the function to highlight the error or display the error message for users to correct their code. **(5%)**
6. Remaining **(10%)** for the quality of your solution, written code, project report, as well as your **planning**.

## Phase 1: Block Design

In the first phase, the student will be familiar with the developing tools and the DMDL language. The main focus will be on the development of the blocks and the setup of the development environment. We will offer a set of templates of the ICON, and the GNU Radio block is also a good reference. The developed blocks should have the property panel which can be opened via double click or right click to enable users to set the properties. The student should refer to the DMDL document to get the properties list of all blocks. The appearance of blocks should be able to transform according to the properties.

### *Additional resources*

- [GNU Radio](#)
- [GR-DMDL repository](#)

### *Completion criteria*

- ✓ A set the DMDL blocks in web which are designed following the DMDL principle.
- ✓ The canvas where users can allocate the blocks.
- ✓ A block panel that displays all blocks for user to select.

## Phase 2: Connection Design

After developing the blocks, the student is supposed to develop the mechanism to connect the blocks. Before developing the connection, the student is supposed to first implement the ports to all developed blocks. The ports should also be further divided into two categories, namely the input port and output port. The ports list is well defined in the DMDL document. The port should also be hidden according to the properties of the block. The connection should be port to port, and the connection should only from output port to input port. Any misconnection should be directly marked by error.

### *Completion criteria*

- ✓ A flow graph which include blocks, ports, and connections.

## Phase 3: Syntax Check

Unlike the normal language, DMDL is a specific language to describe and handle MAC layer protocols. Therefore, it is expected that there is a simple internal mechanism to check the flowchart. A typical error that should be avoided is, if there is a sending block in the design, but there is no block to generate the MAC frame. In other words, the student is supposed to design a method and develop it to trace the information produced and consumed in blocks in the order of the directed flow graph. The detected error should be directly feedback or marked explicitly.

### *Completion criteria*

- ✓ A button which users can click to perform the syntax check,
- ✓ The feedback panel where can display the error information or some effects to highlight and locate the problematic blocks.

- ✓ The algorithm behind to check the syntax.

## **Summary of Deliverables**

For submitting the project, you will need to provide:

1. A well-structured project report that adheres to the course guidelines as well as the required completion criteria for the phases you are delivering.
2. Code repository is containing any self-written code that you have used for your project.
3. A final presentation around 20 mins including a demo.

## **Reading Materials**

The following is a compilation of resources relevant to the project that you might find useful:

- [WaPM18] WANG, PENG ; PETROVA, MARINA ; MÄHÖNEN, PETRI: DMDL: A hierarchical approach to design, visualize, and implement MAC protocols. In: *2018 IEEE Wireless Communications and Networking Conference (WCNC)*, 2018, S. 1–6