Title: STM32 Nucleo L476RG Tutorial: Real-Time FFT with MBED 6 on Keil Studio Online IDE

## Introduction

In this tutorial, we will guide you through setting up the STM32 Nucleo L476RG development board from STMicroelectronics with MBED 6 for real-time Fast Fourier Transform (FFT) analysis. We'll be using the Keil Studio Online IDE for development. This tutorial covers everything from the basics of setting up your development environment to implementing real-time FFT analysis.

## Prerequisites

1. STM32 Nucleo L476RG development board.

2. Computer with a web browser and Internet connection.

3. Basic understanding of C/C++ programming.

4. Familiarity with the MBED development platform.

## Step 1: Set up Keil Studio Online IDE

1. Open your web browser and navigate to [Keil Studio Online](https://keil.arm.com/).

2. Sign up or log in to your Keil account.

3. Create a new project and select the STM32L476RG board from the supported list.

4. Follow the instructions to set up your project in the Keil Studio Online IDE.

## Step 2: Initialize MBED 6 Environment

1. In your Keil Studio project, include the MBED library by adding the appropriate MBED header files.

2. Configure your project settings to use MBED 6 as the target platform.

3. Ensure that the necessary device drivers for the STM32L476RG are included in your project.

## Step 3: Hello World Program

1. Write a simple "Hello World" program to verify your setup.

```cpp

#include "mbed.h"

int main() {

printf("Hello, World!\n");

while(1);

}

```

2. Compile the program and download it to your Nucleo board.

3. Confirm that the program runs successfully on your board.

## Step 4: Real-Time FFT Setup

1. Choose an FFT library compatible with MBED. ARM CMSIS-DSP is a suitable option.

2. Include the necessary CMSIS-DSP headers in your project.

3. Configure the ADC on your Nucleo board to sample analog signals.

## Step 5: Data Collection for FFT

1. Define variables for storing ADC samples.

2. Use the ADC to sample analog signals from sensors or external sources. Ensure the sampling frequency meets your requirements.

3. Store the sampled data in a buffer for FFT processing.

## Step 6: Implementing FFT

1. Include the necessary headers for FFT processing in your project.

2. Initialize the FFT library and provide it with the sampled data.

3. Execute the FFT algorithm on the sampled data.

4. Analyze the FFT output to extract frequency information.

## Step 7: Real-Time FFT Application

1. Integrate the FFT processing into your application loop.

2. Continuously sample data using the ADC.

3. Process the sampled data using the FFT algorithm.

4. Display or output the FFT results in a meaningful format (e.g., plot frequency spectrum).

## Step 8: Testing and Optimization

1. Test your real-time FFT implementation with different input signals.

2. Optimize your code for performance and memory usage if necessary.

3. Consider implementing optimizations such as using fixed-point arithmetic for improved efficiency.

## Conclusion

Congratulations! You have successfully set up the STM32 Nucleo L476RG development board with MBED 6 for real-time FFT analysis using the Keil Studio Online IDE. Experiment with different FFT parameters and optimize your code for better performance. Real-time FFT analysis has various applications in signal processing, audio analysis, and more. Explore further possibilities and continue learning to enhance your skills in embedded development.