



D2.4

Micro-ROS default RTOS Release Revised Software Release

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1 Summary

The second micro-ROS RTOS release presented in this document, is based on the previous version described in deliverable [2.3 micro-ROS default RTOS release Initial](#). In this new release, we have updated the base NuttX version to 7.29, and made improvements in the communication stack, peripheral support and updated reference hardware development platforms' `defconfig` files.

2 Acronyms and keywords

Acronym	Explanation
RTOS	Real Time Operating System
UDP	User Datagram Protocol
6LOWPAN	IPv6 over Low-Power Wireless Personal Area Networks
NSH	NuttX Shell
DAC	Digital to Analog Converter)

3 Overview to Results

This document provides links to the released software and documentation for deliverable D2.4 *micro-ROS default RTOS software release year 2*, that belongs to the Task 2.2 *Platform lower level firmware and libraries*.

3.1 Links to Software Repositories

3.1.1 NuttX repository, based on NuttX 7.29 release

- Git repository: <https://github.com/microROS/NuttX>

Version: NuttX 7.29

Branch name: [master](#)

Release tag : [v0.0.2-alpha](#)

3.1.2 NuttX Apps repository, based on NuttX 7.29 apps release

- Git repository: <https://github.com/microROS/apps>

Version: NuttX 7.29

Branch name: [master](#)

Release Tag: [v0.0.3-alpha](#)

3.2 Introduction

This improvement continues from the results of the deliverable *2.3 micro-ROS default RTOS release Initial*. At that moment, we achieved a stable and functional version of NuttX adapting it to the reference hardware development platforms, the Olimex-STM32 E407 and the STM32L1 Discovery boards. From this point, we continued the effort of updating our fork to have the latest commits from the official repository, improving the performance of the RTOS and giving support for new features required by other consortium members.

Following this path, we did the following improvements:

- NuttX and NuttX's apps update to version 7.29.
- UDP communication stack improvement and the addition of new UDP example in the NuttX app folder.
- The addition of DAC peripheral support.
- The achievement of 6LOWPAN interoperability between NuttX and Linux.

3.3 New NuttX version

We have updated our NuttX and Apps fork to version 7.29. We are focusing our efforts in providing the latest versions of NuttX, so we can benefit from the last improvements the new version gives us, that are developed by the community.

From the previous version, which was based on NuttX 7.26, an important quantity of improvements was made. We want to highlight the following:

- Optimization improvements on the NuttX core.
- Improvement in the 6LOWPAN stack, having a better header compression.
- New options in the NSH console, such as a list of previously written commands.
- Optimization of the UDP stack.

If you want to have the complete list of the latest version release, you can check them in the next release notes: [NuttX Release Notes](#)

During the rebase process, it was necessary to adapt our `defconfig` files to the new version, due to the change the NSH console functionality suffered. This application is always enabled in our NuttX builds, and it was moved from being a system application to be part of the NuttX internal utilities. As we had to revise and update the micro-ROS `defconfigs` we were using, we spend time also in improving the overall configuration of the system. This has resulted in cleaner configuration files with less features we were not using, optimizing the size of compilation.

3.3.1 6LOWPAN Interoperability

In the previous version, we achieved 6LOWPAN communication between NuttX boards. But interoperability with Linux devices was not working. This communication mean is mandatory, as some micro-ROS use-cases requires of wireless communication. So we spent time analyzing the



compatibility among NuttX and Linux 6LOWPAN, and make proper NuttX configuration, so they can communicate.

To accomplish this, it is necessary to set a neighborhood negotiation between them. This negotiation is based on the neighborhood request and `ping` utility. But, unfortunately, this message package is not compatible between both systems. We did [this modification](#) to make it possible.

Once we achieved the neighborhood negotiation and 6LOWPAN communications, we provided a NuttX firmware configuration which makes it compatible with the Linux 6lowpan stack, it is [this one](#). Finally, we developed a NuttX application, which aims to be a demonstrator, that uses 6LOWPAN communication between NuttX and Linux. This application is stored [here](#).

A little reminder, the 6LOWPAN only works on the Olimex-STM32-E407 board. This is because the 6LOWPAN stack doesn't fit on RAM memory of the STM32L1Discovery board.

3.3.2 DAC Support

We added support for DAC to the Olimex-STM32-E407 board. This peripheral takes digital input data and produces a variable output level. This functionality was implemented in the following commits:

- <https://github.com/micro-ROS/NuttX/commit/077983e752b041e210484adda3ff038471ab1cf4>
- <https://github.com/micro-ROS/NuttX/commit/26ef2e967c72a8a658c209bc12d6f596f241f12e>