



Getting Started with Orocos 2.0

Orocos Toolchain Training

About Orocos

Orocos (Open Robot Control Software) is an Open Source C++ software framework for building real-time component-based applications in automation and robotics. The project is structured in 3 major parts: the Real-Time Toolkit (RTT) for building components, the Kinematics & Dynamics Library (KDL) for solving kinematic chains and the Bayesian Filtering Library (BFL) for sensor data filtering and fusion. All three projects can be used independently, but typical robotic applications will use all of them.

The Orocos Toolchain 2.0 marks a new milestone in the development of real-time software components in robotics applications. 4 years after the initial 1.0 release, the robotics software landscape has drastically changed, and the RTT is both following and leading these changes. More than ever are open source projects collaborating to bring the best practice and best experience to the robot builder. The RTT 2.0 focuses on cross-platform, hard real-time communication, inter-operation with other popular robotics platforms and tools (such as ROS and YARP), and at its core, offering a C++ API to build robust and real-time control applications.

The Workshop

Given the above scope, the workshop will demonstrate Orocos using a step-by-step tutorial, followed by a use case which is worked out with the whole group. As such, the programming primitives available in the RTT are first explained and tested by examples with gradual increasing complexity and are the last day applied to a new application built from scratch. At the end of the workshop, the students will have a good feel about what Orocos currently offers, how it can be combined with existing non-Orocos applications or libraries and where it is heading.

Students are working in pairs on a normal Linux development system. Orocos is pre-installed on these systems and the exercises are installed and ready to use.

The modules of the workshop are chosen together with the client.

The Teacher



Peter Soetens is the current maintainer of the Orocos Real-Time Toolkit. He started a company, The SourceWorks, which offers training and custom solutions for businesses and institutes that wish to make use of open source software for building control applications. Having almost 10 years of experience in using and teaching about real-time C++ applications on Linux and embedded systems, makes him the perfect candidate to jump-start a team into using Orocos and real-time Linux in general for writing real-time applications.



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Example Workshop Programme

Day 1 Getting Started

09h00 - 10h15 An Introduction to the Orocos Toolchain - open to all

This presentation introduces Orocos to a wider, technical audience.

10h15 - 10h30 Break

10h30 - 12h15 Getting started with the RTT - max. 6 students

The students are guided through the Orocos hello world examples. The teacher uses Eclipse to show the exercise code and solutions, but the students are free to use their favourite editor.

Creating Packages - TaskBrowser - Threading - Properties

12h15 - 13h00 Lunch

13h00 - 14h30 Getting started with the RTT - part II

Communication between components. The students learn the publish/subscribe and request/reply semantics of communicating components and how these are universally used in robotics applications around the world. They apply these primitives in Orocos components.

Data Flow - Services

14h30 - 14h45 Break

14h45 - 16h15 Getting started with the RTT - part III

Component deployment for application building. Once a few components are available, how are they connected? How are different applications created, using the same components, but with different settings? The scriptable deployment of the Orocos Toolchain answers these questions.

Scripting - Deployment

Day 2 Exploring an Advanced Application

09h00 - 10h30 Distributed communication with Orocos

With the knowledge of day 1, the students play with distributed, communicating components.

Real-time MQueue, ROS and CORBA transports can be used, depending on the interest of the students. They learn how to use the code generators in order to need only minutes for setting this up.

Typekits - Transports - MQueue - ROS - CORBA

10h30 - 10h45 Break

10h45 - 12h15 Advanced controller example - part I

A whole-program exercise is worked out by the students. There are many challenges to solve, such as writing and loading real-time scripts, creating deployment configurations and debugging an Orocos application.

Scripts - State Machines - Advanced Deployment

12h15 - 13h00 Lunch

13h00 - 14h30 Advanced controller example - part II

Continuation of the advanced controller exercise

Reporting - Plotting

14h30 - 14h45 Break

14h45 - 16h15 Advanced controller example - part III

Continuation of the advanced controller exercise

Distribution - Coordinating Components

Day 3 - Running Application in One Day

09h00 - 10h30 Designing an Orocos application from scratch - part I

The students propose an application for Orocos which fits their situation. We first discuss the design of this application. The focus is on: which granularity to use, threading models and the choice between implementing in scripts or C++. Interaction with other robotics libraries and software. This day learns the students how to startup and manage their own Orocos applications

10h30 - 10h45 Break

10h45 - 12h15 Designing an Orocos application from scratch - part II

The students create the basic application layout and generate any necessary typekits for communication between components.

12h15 - 13h15 Lunch

13h15 - 14h45 Implementing an Orocos application from scratch - part I

The group divides the tasks and starts implementing components.

14h45 - 15h00 Break

15h00 - 16h30 Implementing an Orocos application from scratch - part II

Continuation and testing of the application

Additional Available Modules

Real-Time Application Development

Building Orocos components for Xenomai, testing them, validating the real-time performance, learning about hard real-time programming style, debugging.

EtherCat Orocos Component

Learning how to use the EtherCat component for controlling EtherCat devices in hard real-time. Optionally develop a driver for the hardware available at the site.

ROS integration

A module specifically aimed at using Orocos in a ROS environment. Using ROS topics, parameter server and services in Orocos components.

KUKA LWR/FRI interface

Learning how to use the KUKA LWR/FRI component in a hard real-time environment. Does not include KUKA LWR training, the students must understand how to use the LWR.