



# MORPHEUS

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## D2.5.2 Integrated Toolset phase 2 report

CONTRACT NO	MORPHEUS IST 027342
TYPE OF DOCUMENT	Publishable abstract of D2.5.2
DATE	13/06/2009
ABSTRACT	This document is the abstract of the D2.5.2. It is available on the MORPHEUS public website
AUTHOR, COMPANY	Philippe BONNOT, TRT
CO-AUTHORS	Paul BRELET, Philippe MILLET, Arnaud GRASSET, TRT WP2 partners Indirect contribution of WP5 partners and ST/ARCES team
WORKPACKAGE	WP2
CONFIDENTIALITY LEVEL	PU
FILING CODE	MORPHEUS-TRT-D252-R2.1.doc

## Context

This deliverable is part of the MORPHEUS project which is a European initiative financed under the 6th FP and addresses innovative solutions for embedded computing based on dynamically reconfigurable platform and tools.

MORPHEUS project aims at satisfying embedded systems new demanding requirements in terms of computing performance, cost-efficient development, functional flexibility and sustainability by developing a global solution based on a modular heterogeneous SOC platform providing dynamically reconfigurable computing completed by a software oriented design flow and a consistent toolset.

MORPHEUS is a 3-year project started in 2006 and gathering all the required expertises from several countries : academics, industrials, SMEs.

## Aim of the deliverable

The purpose of this deliverable is to provide a report on the MORPHEUS integrated toolset development. This includes a description of the toolset development status and a description of its advantages.

## Content of the deliverable

This deliverable is a draft version to show the current status before the final version at the end of the project.

The purpose of this deliverable is to provide a report on the MORPHEUS integrated toolset development. This includes a description of the toolset development status and a description of its advantages. The toolset contributes to the objectives of the MORPHEUS platform. The goals of the tools are thus: to increase the application development productivity, to allow the flexibility and the high performance of the platform (flexibility is considered here as the ability to quickly and easily modify the functions offered by the reconfigurable engines).

The deliverable first provides generic information about the toolset utilisation so that the reader understands its simplicity. The installation of the tools is explained in appendix. Installing the complete toolset just consists in typing a command launching the global makefile script. The approach of the MORPHEUS toolset provides both an effortless management of reconfigurable accelerated functions within a global application C code and an easy design of the accelerated functions through high level description and synthesis. The interest of the toolset is particularly high since the MORPHEUS architecture is powerful thanks to its reconfiguration capabilities but is also complex. The toolset objective is to hide this complexity to the programmer while keeping good performances. The toolset is indeed integrated since the programmer only makes use of the SPEAR design environment plus the automatic compilation chain.

The first step of the approach is to write a C code program of the full application. The programmer then has to identify some reconfigurable accelerated functions in its application. The next step is the design of these accelerated functions thanks to the graphical environment and the C code for basic kernels of the accelerated functions. Then the programmer has to insert compilation directives in its application C code to specify the functions that have to be accelerated. The programmer also has to write a "configuration file" to specify on which HRE the accelerated function has to run. Then the executable files for the MORPHEUS platform are built from the provided makefile.

The complete toolset has been developed and integrated. Some limitations still exists and are presented in this deliverable (limitations notably on data format and conditional instructions). However, complete applications can be tested. Examples taken from the applications of the project permit to illustrate and assess the different aspects of the toolset on real cases. The focus was made on the motion detection application for smart cameras and on the wireless communication application. The complete flow of the toolset was involved to generate the executable code for these applications on the SystemC model of the MORPHEUS platform. The expected results have been obtained.

The toolset assessment performed with the selected applications shows significant productivity gains in comparison with code written outside the integrated toolset. Supplementary productivity gains concern

debug time and time to learn the tools. It is clear that the toolset enables flexibility thanks to the easy reconfiguration management notably thanks to the MOLEN compilation directives and the underneath reconfiguration services.

Beyond the MORPHEUS project, future developments could include the opening of some parts of the toolset sources for dissemination with possible plug-in of other tools (other synthesis tools, other specification tools, etc). Moreover, the proposed approach is quite generic and further developments could target other reconfigurable architectures.