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CDNLive EMEA 2017

SKILL Application Manager (SAM)
Simplify Your Software Development in Virtuoso

Florian Leber
Robert Bosch Center for Power Electronics
Reutlingen University, Germany
Agenda

- Introduction
- Motivation and Goals
- Implementation
- Demo
- Conclusion and Outlook
Introduction – rbz

Robert Bosch Center for Power Electronics
Reutlingen University • University of Stuttgart • Robert Bosch GmbH

Partners

Hochschule Reutlingen
Reutlingen University

University of Stuttgart
Germany

Academia

Sponsor

BOSCH
Invented for life
Introduction – rbz

- Research and Teaching Network for Power- and Microelectronics
- Founded in 2009, Started in 2010
- Funding until 2020: Robert Bosch GmbH → 20 Mio €
  Baden-Württemberg (MWK) → 10 Mio €
- Why? → Urgent industrial Need of Experts: Bachelor, Master, PhD
- Bosch: Scholarship Program, Student Loans,
  Working Contracts for Students, Master Thesis,
  Doctoral Program

A Unique Academic Institution in Germany
Introduction – rbz

Complete Infrastructure for Teaching & Research
- 1800 m²
- Offices
- 3 Lecture Rooms
- 4 Electronics Labs (research, students)
- 2 EDA labs (full Cadence Flow)

rbz - Reutlingen Site

Staff
- 4 Professors
- 25 Academic Employees, thereof 21 PhD Researchers
- still growing
Introduction – rbz

Universität Stuttgart

Robust Power Semiconductor Systems
Prof. Dr.-Ing. Ingmar Kallfass

Power Electronics Components
Prof. Dr.-Ing. Martin Pfost

Power Electronics Systems and Drives
Prof. Dr.-Ing. J. Roth-Stielow

Electronic Design Automation
Prof. Dr.-Ing. Jürgen Scheible

Semiconductor Technology
Prof. Dr.-Ing. Jörg Schulze

Integrated Circuit Design
Prof. Dr.-Ing. Bernhard Wicht
Introduction – rbz

EDA Research

Electronic Design Automation with focus on
• Automation of analog IC design flow
• Verification of analog IC designs
• Electrothermal simulation

Research projects
• Layout module generators
• Schematic generators
• Re-Use methodology for analog circuits
• Verification of layout generators
• Detection sensors for bond delamination

Prof. Dr.-Ing Jürgen Scheible
Master Program: Power Electronics and Micro Electronics

- 4 Semesters
- Master of Science (M.Sc.)

**Power Electronics and Micro Electronics**

- **Analog Integrated Circuit Design**
  - Amplifiers
  - Oscillators
  - DACs, ADCs
  - Linear regulators (LDO)
  - DCDC converters
  - Power switches
  - Gate drivers
  - Layout

- **Semiconductor Devices**
  - Semiconductor physics
  - Diodes
  - Transistors
  - SCR / thyristor
  - IGBT
  - Thermal behavior

- **Digital Circuits**
  - FPGA structures
  - VHDL / Verilog
  - Synthesis
  - Verification
  - HW/SW co-design

- **Power Electronics**
  - Equivalent circuits
  - Passives
  - Magnetics
  - Converter architectures
  - Drivers
  - Pulse-Width-Modulation

- **Electronic Design Automation**
  - Design tools and flows
  - Layout Synthesis

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Florian Leber | Reutlingen University | Robert Bosch Center for Power Electronics | www.rbzentrum.de
florian.leber@reutlingen-university.de | Phone +49(0)7121 271-7124
Student Chip Design Lab

2. Semester: Circuit Design – Layout Design – Tapeout

Semester Break: Waferfab

3. Semester: Lab
EDA Teaching
• 3 Lectures (Layout Design, Digital Synthesis, Algorithms)
• 5 practical courses

Lecture: Algorithms for Layout Synthesis
• Lecture with integrated exercises
• Floorplanning
• Placement
• Route
Introduction – rbz

EDA Teaching
- 3 Lectures (Layout Design, Digital Synthesis, Algorithms)
- 5 practical courses

Lecture: Algorithms
- Lecture with
- Floorplanning
- Placement
- Route
Introduction - SKILL

- SKILL
  - Lisp dialect
  - Scripting language in Virtuoso

Lisp Style:

```lisp
(printf "Hello World!"
```

C Style:

```c
printf( "Hello World!" );
```
Motivation and Goals

• Observed weaknesses:
  
  – The manual organization of source code reduces the effective time available for working on the exercise.
  
  – In some exercises we provide prepared source code to ease the work. It has shown that the integration of these source code is error-prone.
  
  – Students often have problems to extract the relevant source code for their report.
  
  – Students struggle with simple tasks like load and run of source code.
Motivation and Goals

• Idea
  ─ Automate recurring work steps
  ─ Graphical user interface
  ─ Adopted well-known features from modern IDEs

• Goal
  ─ An automated organization of source code in a folder structure with import/export functionality
  ─ An automated compilation and execution of selected source code

→ Skill Application Manager
Implementation

- SKILL Application
- ~1800 LOC
- GUI
- Import und Export
- Load and Run
Implementation – Folder Structure

- Workspace
- Application
- .sap File
- *.il File
Implementation – Tool Architecture
Demo
Demo

Virtuoso® 6.1.6-64b - Log: /home/no/layoutspace/test/CDS.log

was checked out successfully. Total checkout time was 0.34s.
Demo

Virtuoso 6.1.6-64b - Log: /home/flo/layoutspace/test/CDS.log

Loading ci.cxt
Loading ams.cxt
Virtuoso Framework License (LLI) was checked out successfully. Total checkout time was 0.34s.

SAM: Change Workspace?

Do you want to change workspace directory?

Selected workspace directory: /home/flo/layoutspace/cdnlive/skill

Do not ask again  Yes  No
Demo
Demo
Demo
Demo
Demo
Demo
Demo
Demo
Demo
Demo
Demo
Demo
Demo
Demo

```
  (defun printTextFunction ()
    (let ()
      nil
    )
  )
```
Demo

```lisp
(defun printTextFunction ()
  (let ()
    nil)
)
```
Demo

```lisp
(defun printTextFunction ()
  (print)

  (printf
   print
   println
   println
   printString
   printStruct
   printBlend
   printError
   printFunctions
  )
)
Demo

```
(defun printTextFunction ()
  (printf "")
)
```
Demo

```lisp
(defun printTextFunction ()
  (printf "CDNLive 2017\n")
)
```
Demo
Demo
Demo

```
***** rbzSAM - Load - Name:"CDNLiveExample" Run:"printTextFunction"
function printTextFunction redefined
***** rbzSAM - Run - Name:"CDNLiveExample" Run:"printTextFunction"
CDNLive 2017
***** rbzSAM - Return (preRun Run postRun) : '(nil t nil)"
```
Demo
Demo
Demo
Demo
Demo
Demo
Demo

[Image of a computer interface showing a SAM Import App window with a selected SAM file path]

Selected SAM-File: /flo/layoutspace/cdnlive/Exercise_Lee.sam

OK  Cancel  Help
Demo

![Image of demo interface]

<table>
<thead>
<tr>
<th>Name</th>
<th>Description</th>
<th>Path</th>
</tr>
</thead>
<tbody>
<tr>
<td>myFirstApplication</td>
<td>My first application</td>
<td>/home/flo/layoutspace/cdnlive/skill/myFirstApplication</td>
</tr>
<tr>
<td>Exercise_Lee</td>
<td>Exercise: Implement a Lee algorithm</td>
<td>/home/flo/layoutspace/cdnlive/skill/Exercise_Lee</td>
</tr>
<tr>
<td>CDNLiveExample</td>
<td>Example for CDNLive</td>
<td>/home/flo/layoutspace/cdnlive/skill/CDNLiveExample</td>
</tr>
</tbody>
</table>
Demo
Conclusion and Outlook

• Conclusion
  ─ very user-friendly organization and execution of source code
  ─ manual effort is reduced
  ─ errors are avoided
  ─ comfortable way of developing SKILL application
  ─ practical programming courses at Reutlingen University

• Outlook
  ─ facilitate cooperative software development
  ─ integrating the version control system “git”
  ─ import/export functionality for virtuoso libraries
SAM is OpenSource

SAM is OpenSource
MIT-License

Download:
github.com/rbzentrum/SAM
Thank you for your attention