Test-Stand for High-Performance FPGA Computing Module

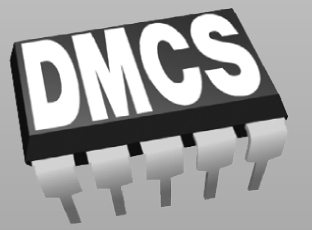
Aleksander Mielczarek,
Dariusz Makowski

Department of Microelectronics and Computer Science
Lodz University of Technology, Poland

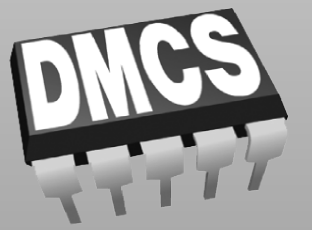
Hamburg, 11th of December 2014
3rd MicroTCA Workshop for Industry and Research

Presentation Outline

- Motivation for Test-Stand Development
- High-Performance FPGA Computing Module
- Scope of Automated Tests
- Hardware Solution for Test-Stand
- Software Solution for Test-Stand
- Conclusion

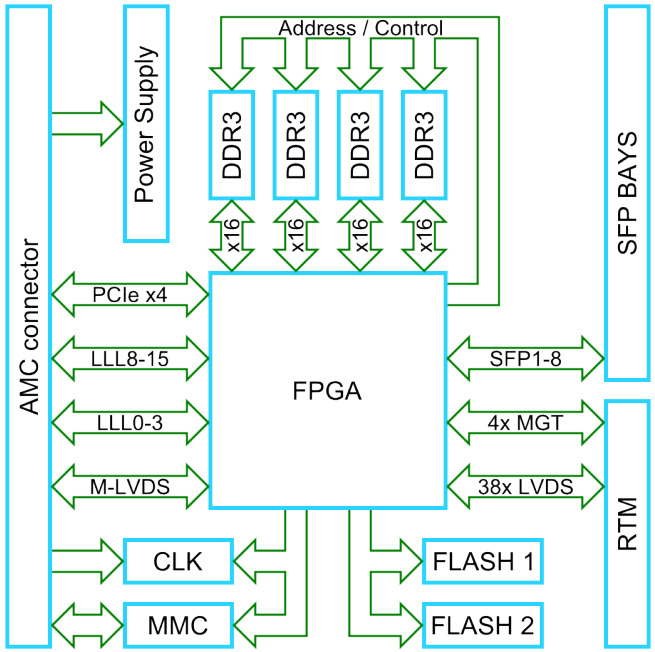


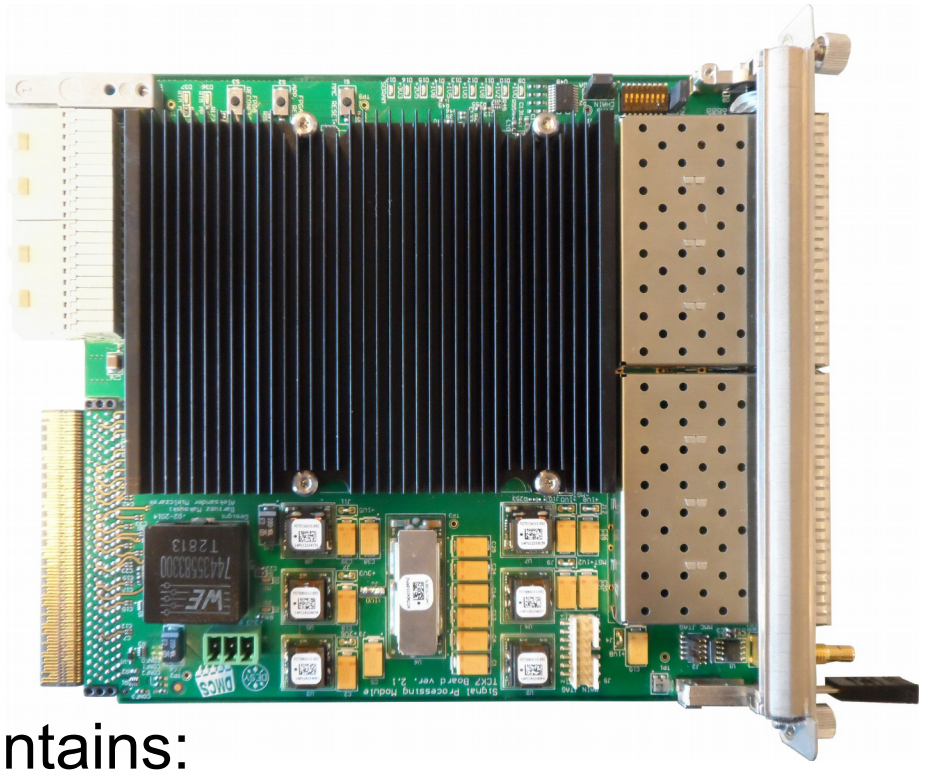
Motivation for Test-Stand Development



- TCK7, an AMC computing module was developed for DESY by DMCS,
- the module was commercialized by Vadatech as CM045,
- 10 already manufactured, 40 more to come,
- each module has to be tested to detect possible assembly problems.

High-Performance FPGA Computing Module





CM045 / TCK7 module contains:

- Kintex-7 FPGA,
- 16 Gb of RAM,
- 28 multi-gigabit links, up to 12.5 Gb/s per link,
- 2 SPI FLASH memories.

Department of Microelectronics and Computer Science

Scope of the Tests #1

Legacy CM045 Test reports:

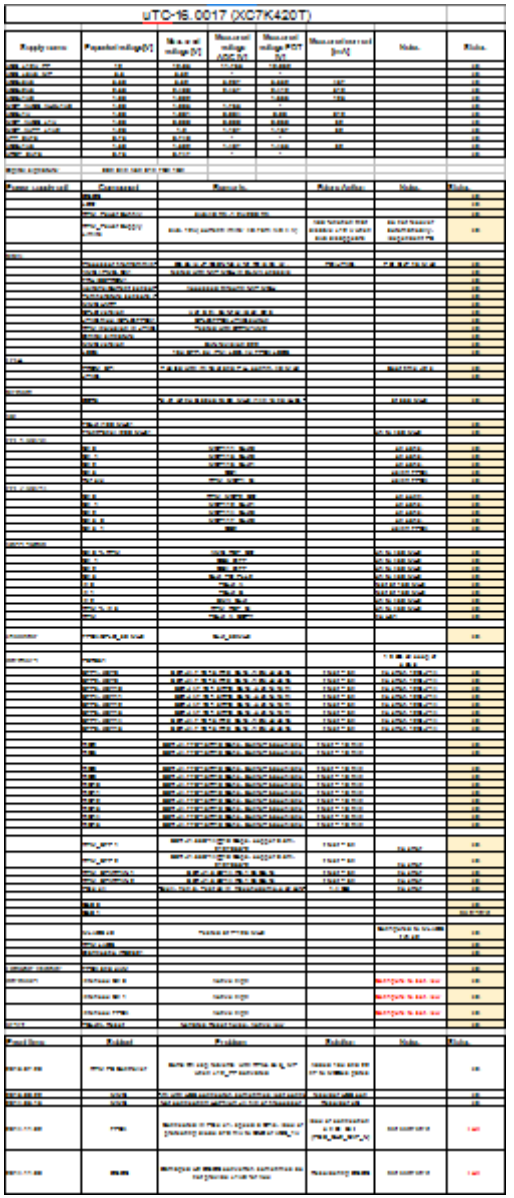
- about 140 simple tests/measurements,
- several hours to complete one report.

Can these be done automatically?

YES!

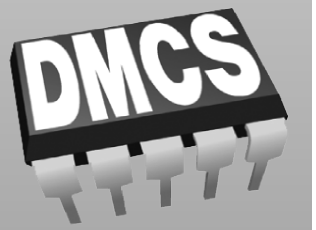
Can we get the same test coverage?

Well, NO, but...



Department of Microelectronics
and Computer Science

Scope of the Tests #2



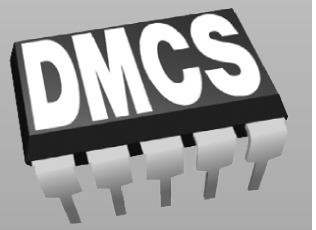
No, but:

- we can still get about 90% coverage,
- some of the test were redundant.

So, by doing an automated test-stand:

- it is possible to greatly speed up the testing,
- the tests can be more repeatable,
- no need for writing down the measurements,
- preparation of measurement reports is much faster.

Scope of the Tests #3



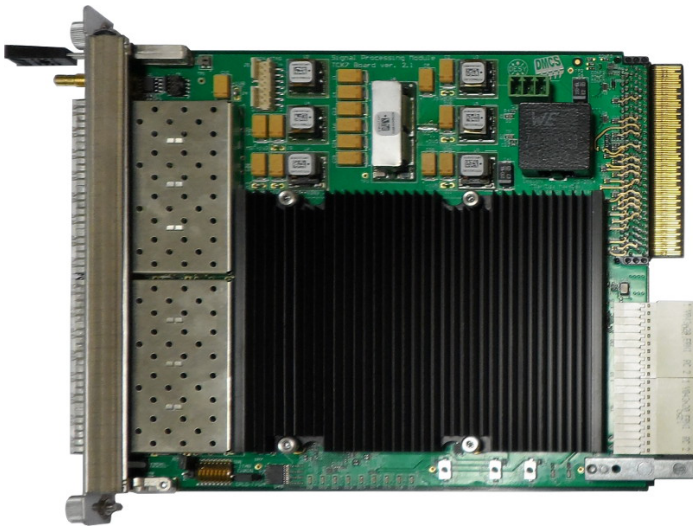
Department of Microelectronics
and Computer Science

What will be measured / verified:

- 8 power supply voltages,
- 5 temperature sensors,
- 9 clock signals, 2 PLLs,
- operation of FPGA, CPLD and MMC,
- operation of 16 multi-gigabit links including PCIe x4,
- DDR3 memory access,
- RTM board communication
  (IPMI, parallel LVDS link, multi-gigabit links),
- SPI FLASH memory access,
- front panel LEDs.

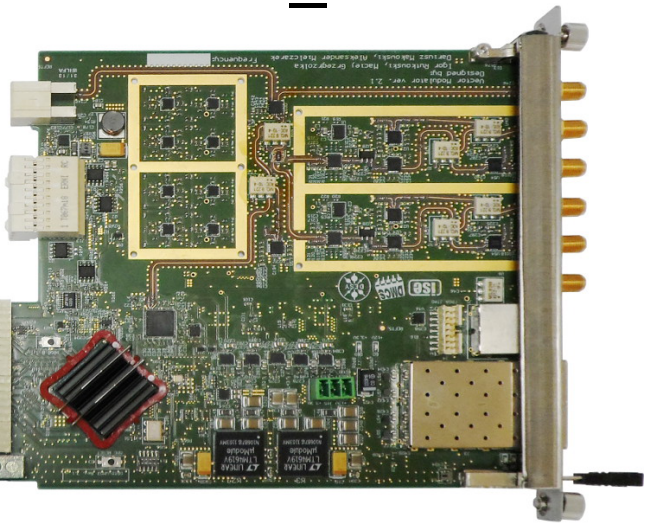
Hardware Solution for Test-Stand #1

CM045



- Test-Stand bitstream
- Firmware upgrade bitstream
- MMC firmware
- CPLD application

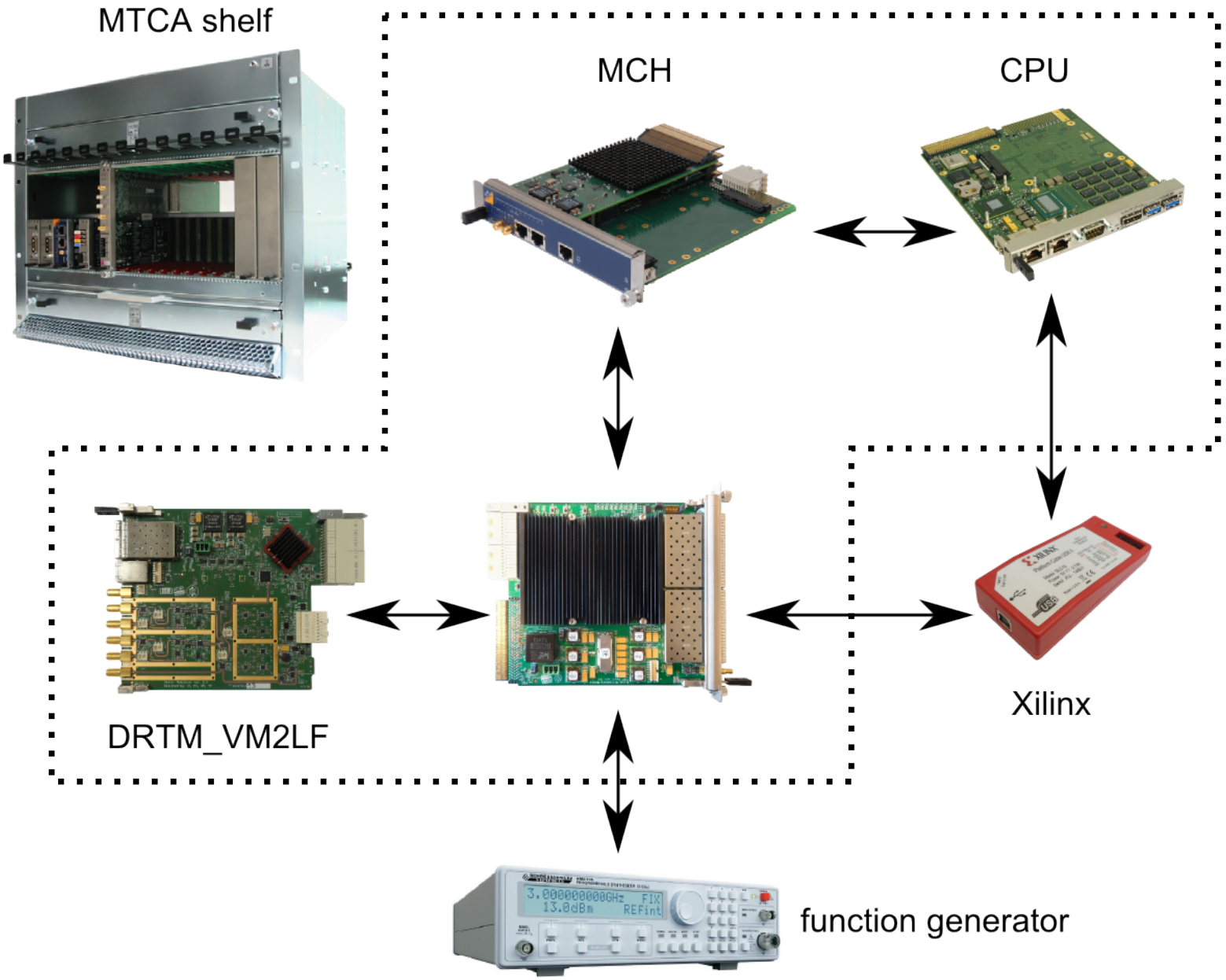
DRTM_VM2



- Test-Stand bitstream

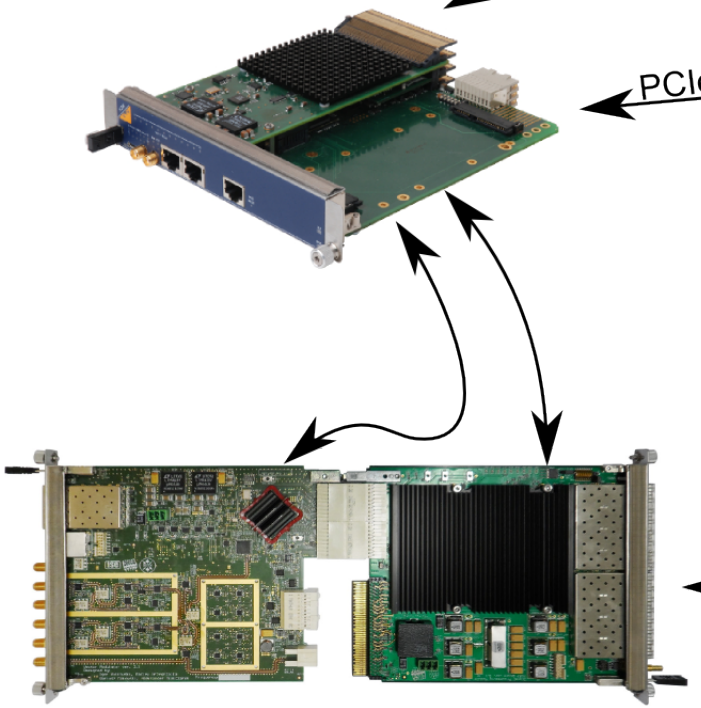
Hardware Solution for Test-Stand #2

CM045/TCK7
Test-Stand



Department of Microelectronics
and Computer Science

Software Solution for Test-Stand #1



Ethernet

ipmitool

- enumerate boards,
- check IPMI interface,
- read sensors & FRU,
- RTM communication.

PCIe

llrfuni

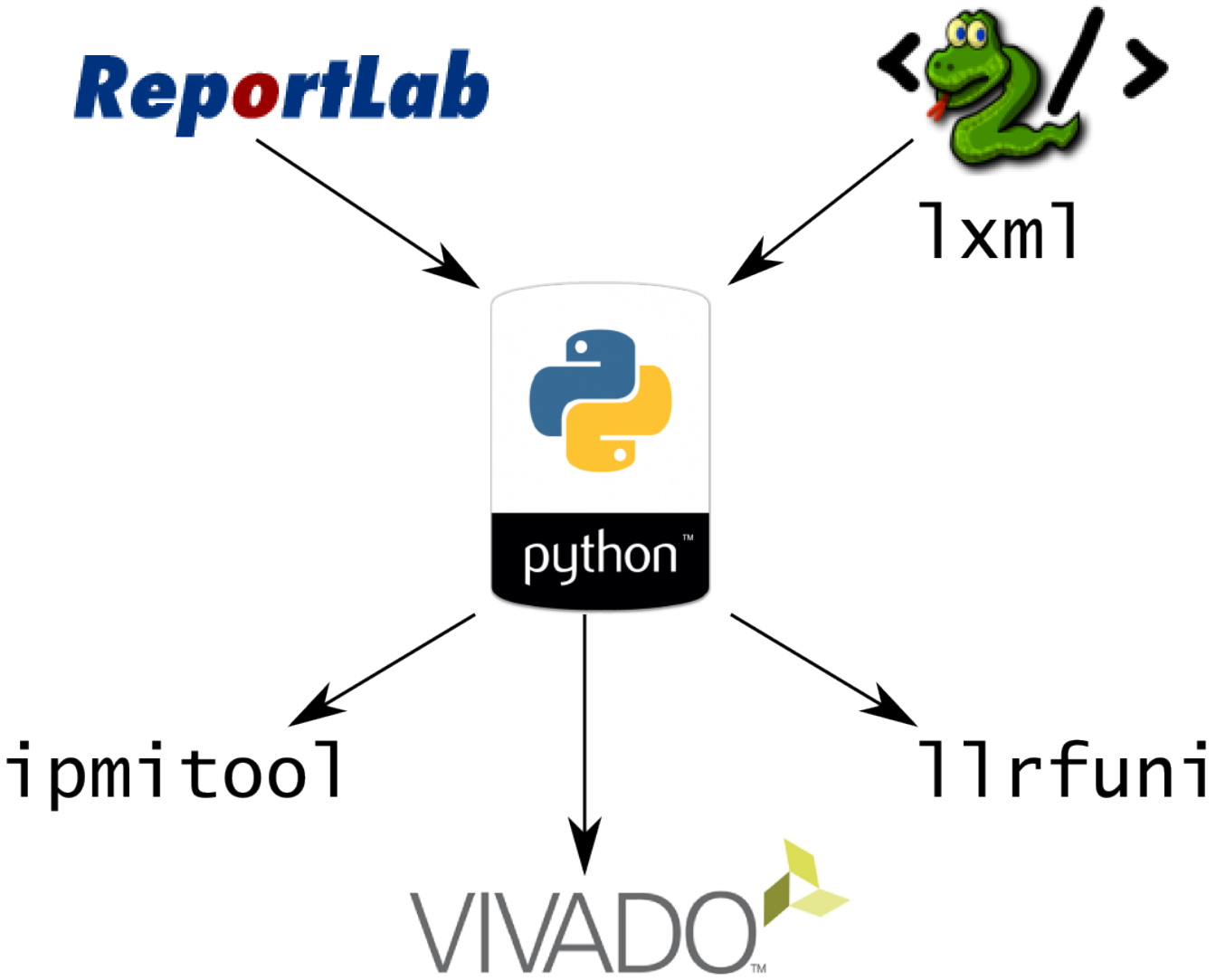
- PCIe bus test,
- DDR3 test progress,
- clock frequencies.

VIVADO

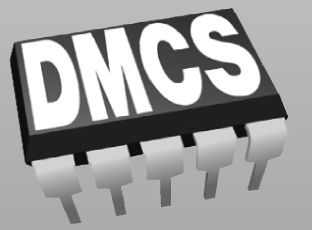
- FPGA circuit detection,
- FPGA programming,
- IBERT results readout.

Department of Microelectronics and Computer Science

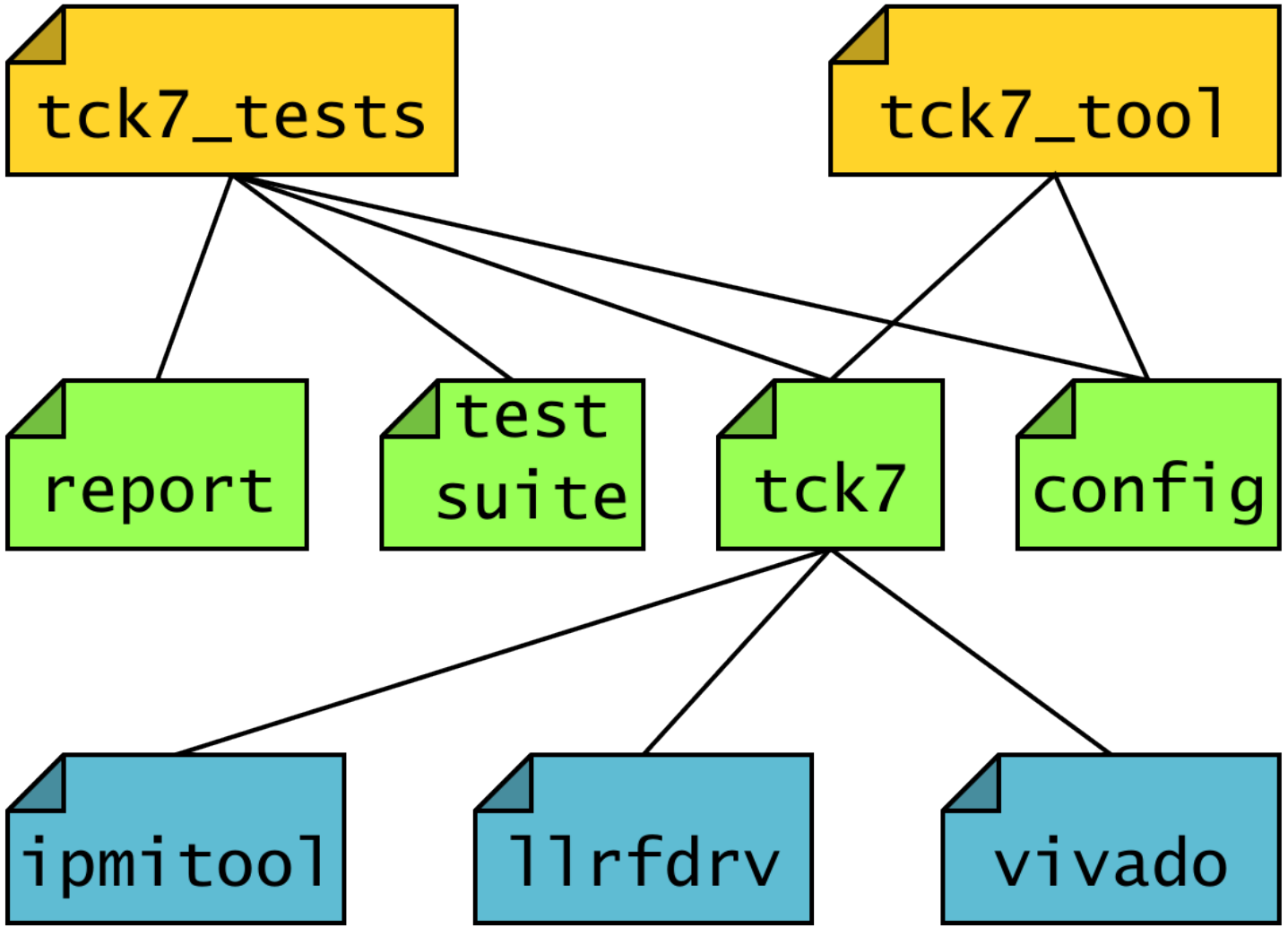
Software Solution for Test-Stand #2



Software Solution for Test-Stand #3



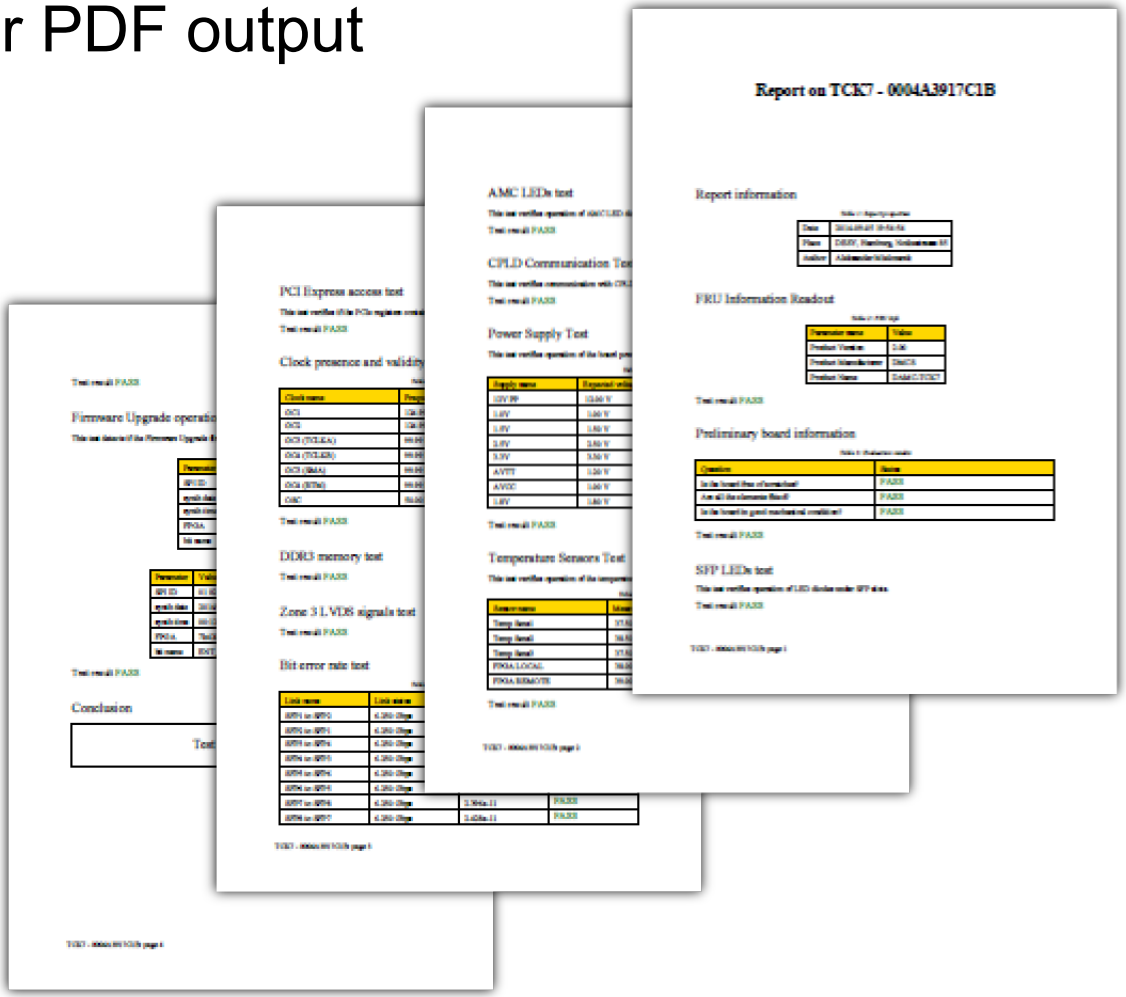
Department of Microelectronics
and Computer Science



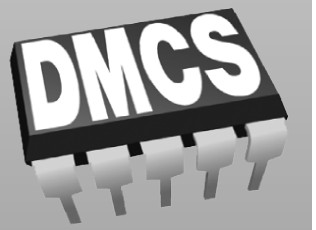
Software Solution for Test-Stand #4

ReportLab

for PDF output

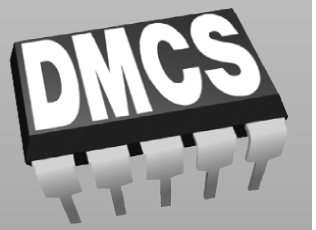


Conclusion



The developed Test-Stand:

- requires only single GNU/Linux machine to run,
- can be installed on MTCA compliant CPU,
- does not require any dedicated hardware,
- uses only free and open source components,
- saves a lot of tester's time,
- covers almost all of the functionality ever used,
- improves test repeatability,
- generates a nice report.



Department of Microelectronics
and Computer Science

Thank you for your attention.