TU Graz

SCIENCE
PASSION
TECHNOLOGY

Digital System Integration and Programming

Barbara Gigerl, Rishub Nagpal

October 5th, 2022

Outline

1. Digital system integration and programming

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2. About this course

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3. Outlook: Projects

What is digital system integration and programming?

Digital system integration

- Digital systems: very complex
- System integration: connect multiple complex systems to achieve a certain goal

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...and programming

- Hardware and Software

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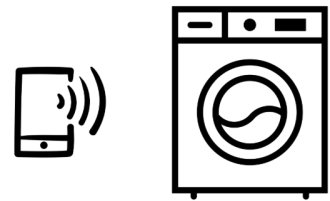

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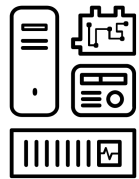

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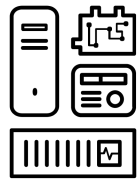

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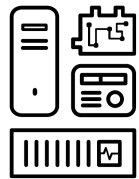

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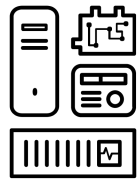

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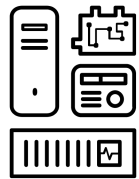

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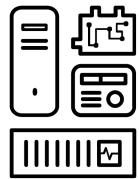

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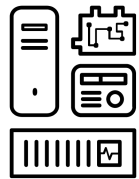

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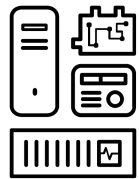

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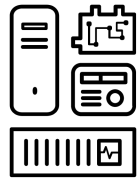

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- Today: SoC is the state-of-the-art principle for designing chips.

SoCs are everywhere

Smartphones

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Tablets

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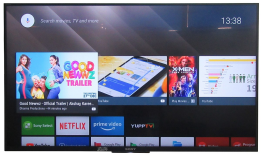

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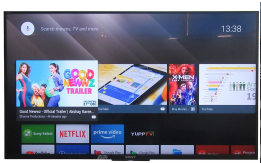

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  - SPU: dedicated subsystem for boot-loader, key management unit, crypto accelerators, ...

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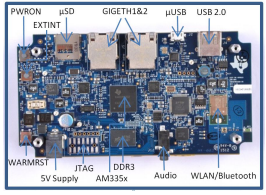
- SoC for industrial applications



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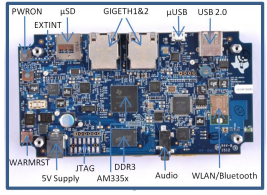

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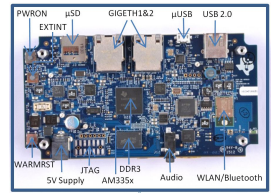

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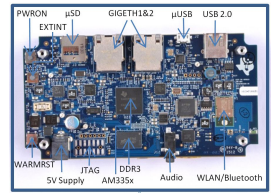
- On-chip quad-core PRU (Programmable Realtime Unit)



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- A bus connecting all components: AMBA, AXI, CoreConnect, ...

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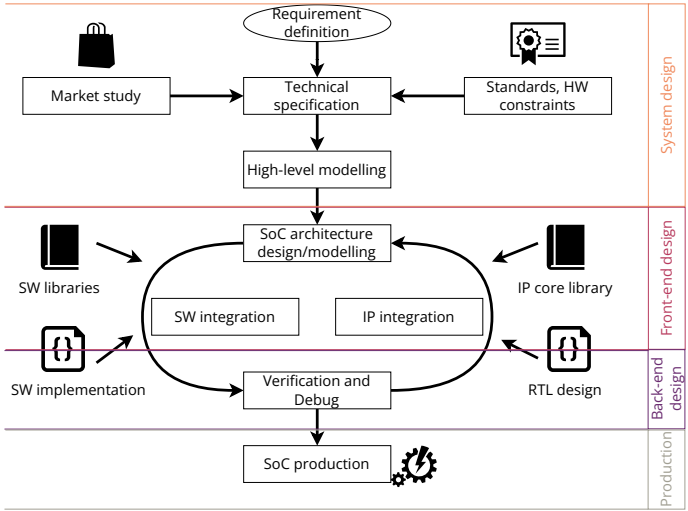
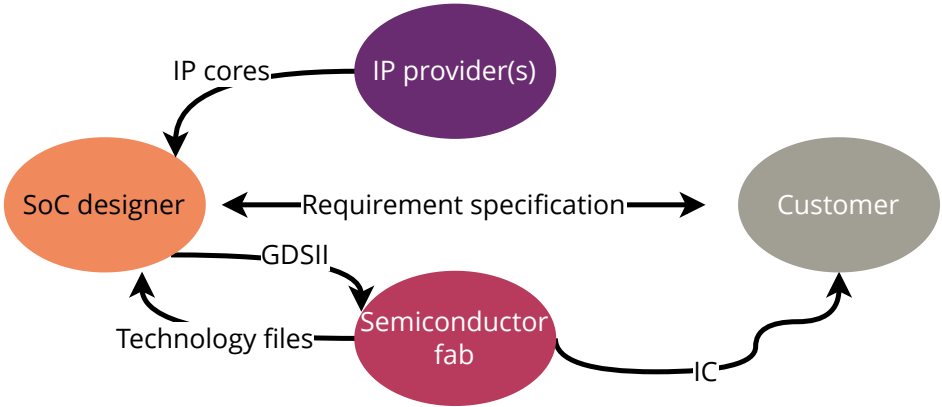
Disadvantages:

- Resulting system is very complex
- High design and development costs

SoC Design Methodology



SoC Players



- GDSII: data format to describe ICs
- Technology file: information about manufacturing (metals, IC layers, ...)

Who are we?

Barbara Gigerl

PhD student @ Graz University of Technology

Formal Verification of Side-Channel Protected Implementations

barbara.gigerl@iaik.tugraz.at

sip-team@iaik.tugraz.at

Who are we?

Rishub Nagpal

PhD student @ Graz University of Technology

Power side-channel attacks and defenses for cryptographic implementations

rishub.nagpal@lamarr.at

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Topics for Master Thesis

Looking for a master thesis?
→ https://www.iaik.tugraz.at/teaching/master-thesis/
We have lots of interesting open topics :)

Alternatively, email us:

- barbara.gigerl@iaik.tugraz.at
- rishub.nagpal@lamarr.at

Contact

- General information:
  https://www.iaik.tugraz.at/sip
- Questions and concerns by E-Mail
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- Project driven work (group-oriented, project-centric)

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Team work

- Team Size for Project 1: 1
- Team Size for Project 2: 3
- Team Size for Seminar presentation: 1

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Deadline: Monday, 10.10., 23:59

[1] You can try your luck before/after

Registration Process

1. Find a group
2. Find and register your group: mailto:sip-team@iaik.tugraz.at
3. Wait for the confirmation mail to get your group number
4. Decide when to pick up the hardware (IF01052, Mo-Fr 10:00-16:00[1])
5. Choose a seminar topic
6. Register for a seminar topic: https://bit.ly/3dZjipp

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Schedule of SIP 2022

Project meetings

- Regular weekly meetings: Wednesday 10:00 - 12:00, IFEG042

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4. Seminar talk + discussion
5. ...

Preliminary timeline

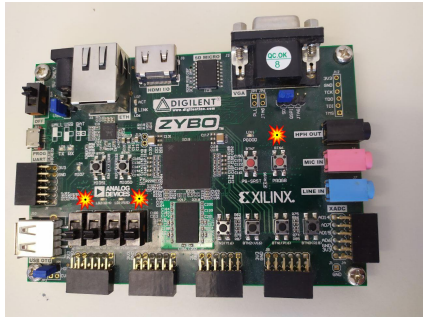
Date	Topic
05.10.	Kick-off / Introduction to Seminar Topics / SoC Design Flow Tutorial
12.10.	Embedded Linux Tutorial / Presentation Project 1
19.10.	Debugging Tutorial
26.10.	Bank holiday (no meeting)
2.11.	Bank holiday (no meeting)
9.11.	Presentation Project 2a+2b / Seminar talks
16.11.	Seminar talks
23.11.	Seminar talks
30.11.	Seminar talks
7.12.	Seminar talks
14.12.	Seminar talks
11.01.	Seminar talks
18.01.	Seminar talks
25.01.	Seminar talks

Important Dates and Deadlines

Date	Topic
10.10., 23:59	Deadline Group Registration
8.11., 23:59	Deadline Project 1
9.11.-16.11.	Exercise Interviews Project 1
6.12., 23:59	Deadline Project 2a
7.12.-13.12.	Exercise Interviews Project 2a
17.01., 23:59	Deadline Project 2b
18.01.-24.01.	Exercise Interviews Project 2a

Project 1: Fancy Lights

- Get to know the board and run through all steps



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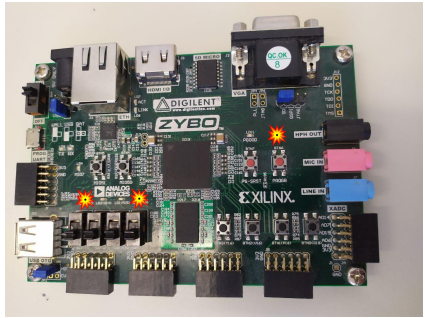

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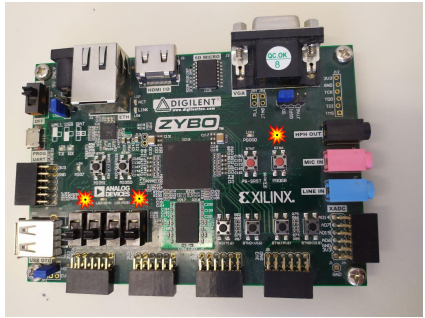

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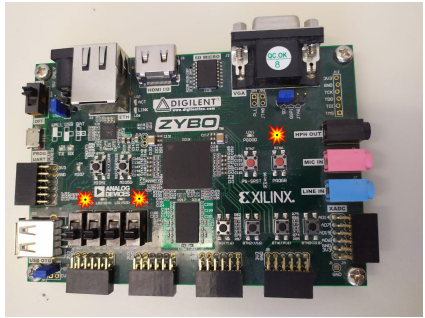

Project 1: Fancy Lights

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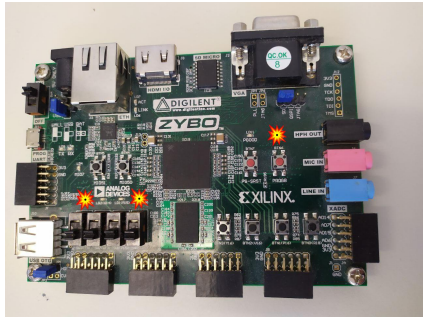
- Design hardware, build a driver, write an application
- Access the LEDs from a bare-metal application and from within Linux
- No team work; everybody should do all steps (share your board within group)
- Aim: After completing, everybody should have the same basic knowledge.



Project 2: Display for Encrypted Images

- Use knowledge from Project 1 to build larger system
- Receive encrypted image via Ethernet, decrypt it in hardware and display it via HDMI
- Team work
- Aim: Get some deeper understanding of the topic