Modular Reconfigurable Intelligent Surfaces: Towards an Application-Adaptive Implementation

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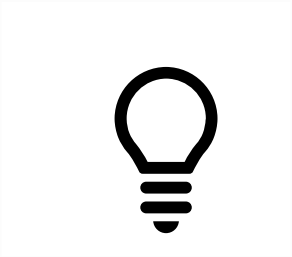
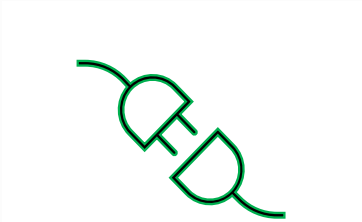
27. ITG Fachtagung Mobilkommunikation
Osnabrück
10th May 2023

RPTU Rheinland-Pfälzische Technische Universität Kaiserslautern Landau

Agenda



Introduction and motivation



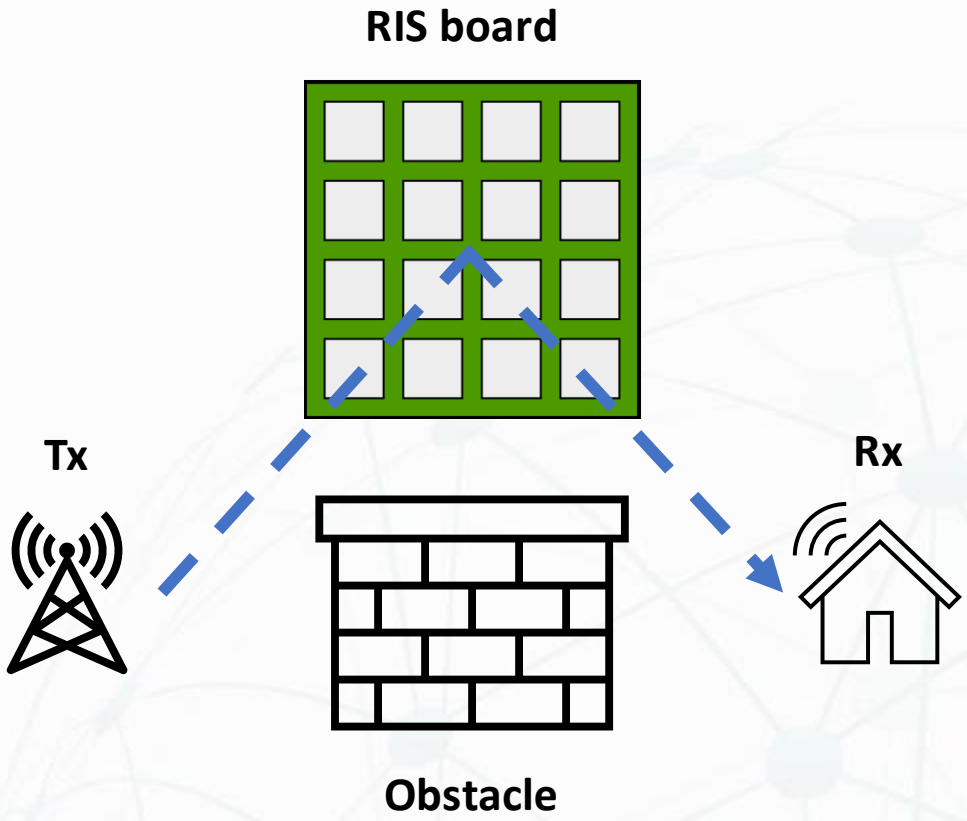
Modularity regarding RIS

Design and implementation

Conclusion and outlook

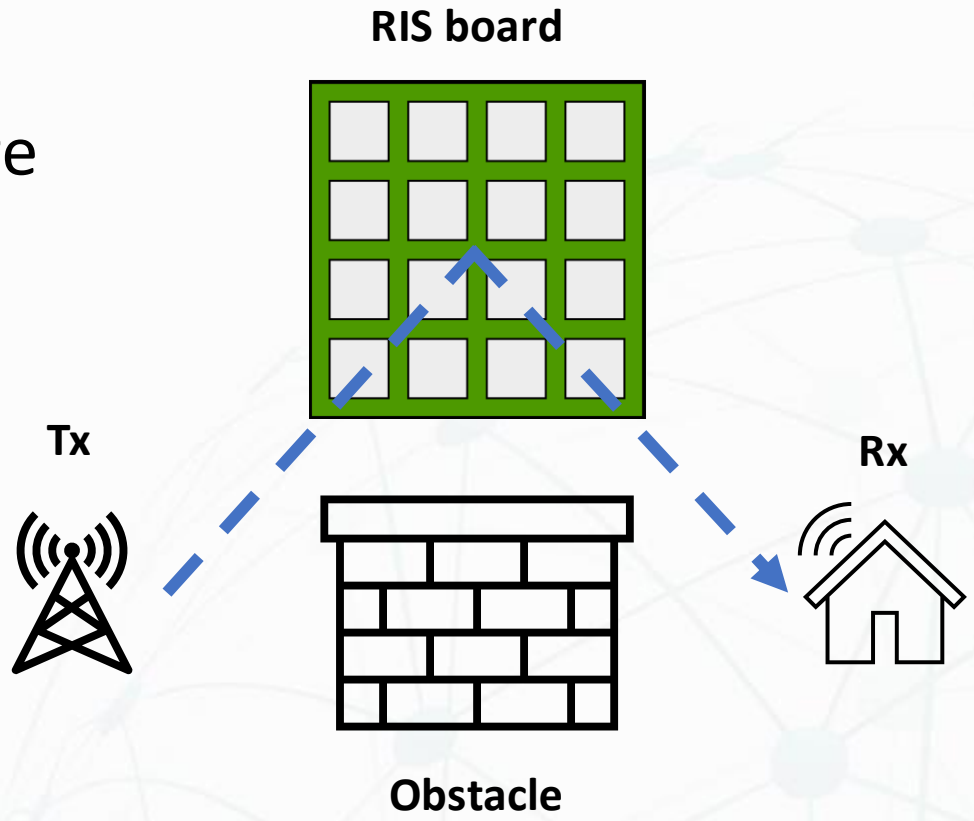
Introduction

- RIS: An array of individually tuneable antennas
- 6G enabler technology
- Fixed size units
- Design based on use cases



Motivation and related work

- Passive RIS system; current literature focus more on active RIS systems
- IoT applications
- User-friendly framework
- Low-cost hardware

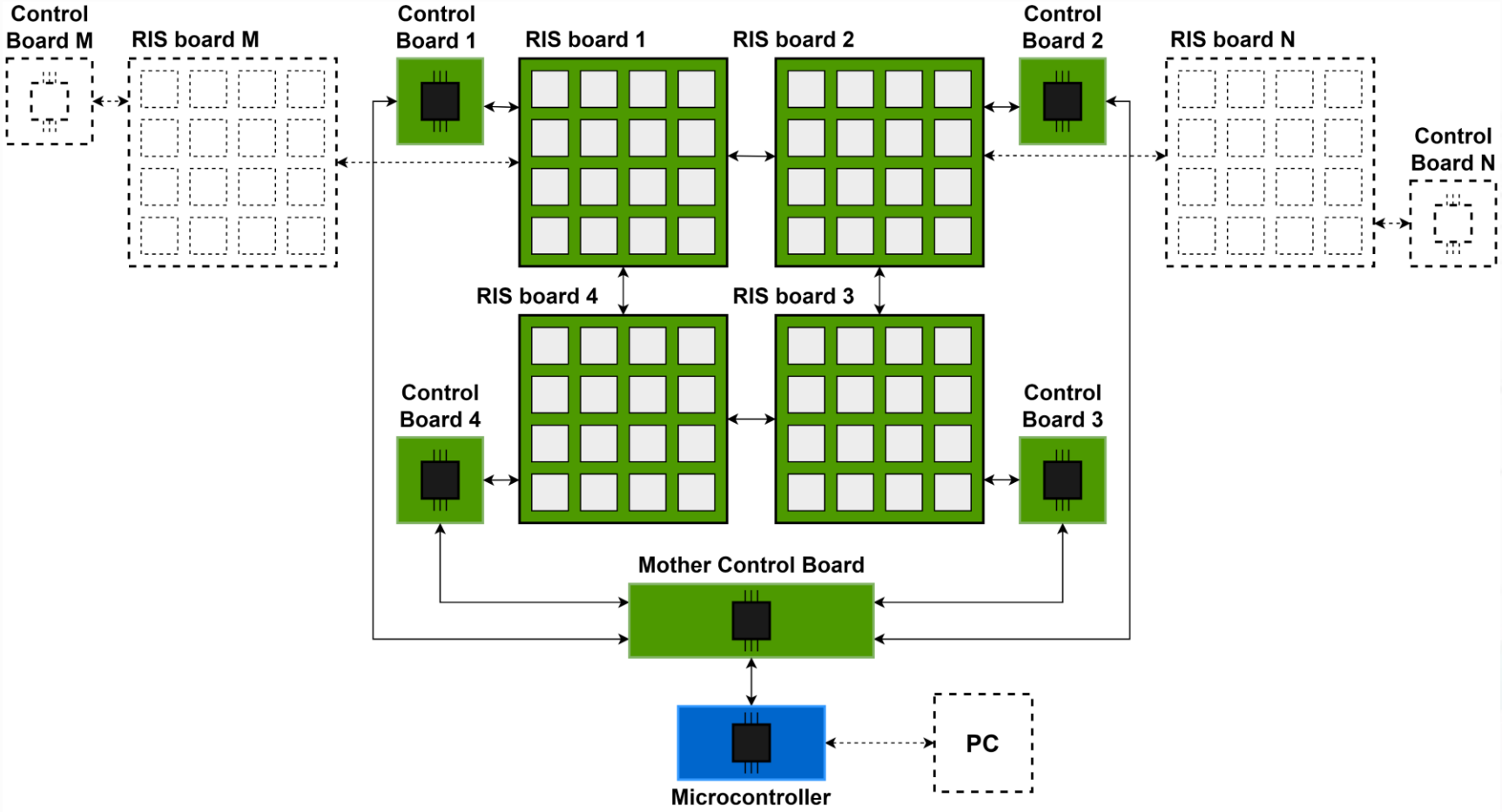


Modularity regarding RIS

- Cost-effectiveness
- Adaptability
- Flexibility
- Maintainability

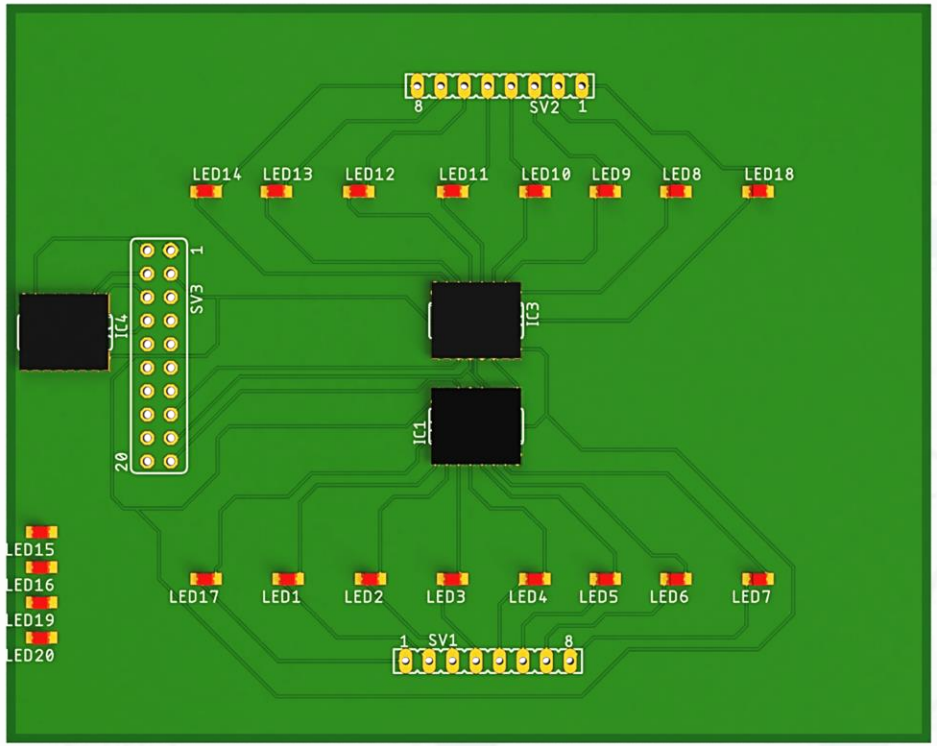
- Coordination
- Power management
- Cost efficiency
- Signal interference

Proposed Modular Concept



Control board

- Once for each RIS subblock
- LED status indicators
- PISO and SIPO shift registers



Design and Implementation

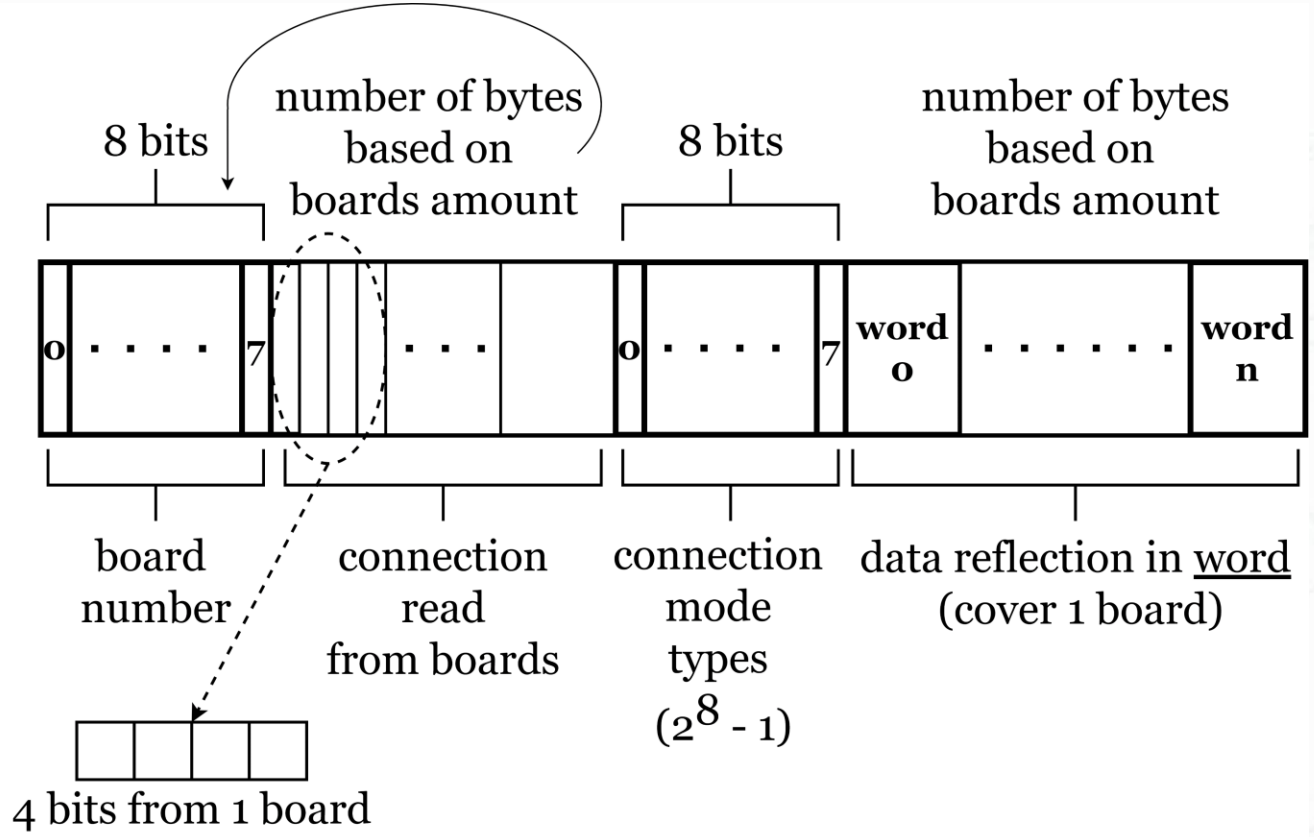
Firmware workflow

Algorithm 1 Firmware Workflow

```
1:  Procedure for Workflow :
2:  n ← Board Number
3:  Main:
4:      Buffer initilization based on board number
5:      Buffer ← read board connection information
6:      if (Buffer = = specific connection mode) then
7:          transmit corresponding reflection pattern
8:      else
9:          go to step 5 and wait for more connections
10:     end if
11:     if (info ← new connection) then
12:         goto Main
13:     end if
14: close;
```

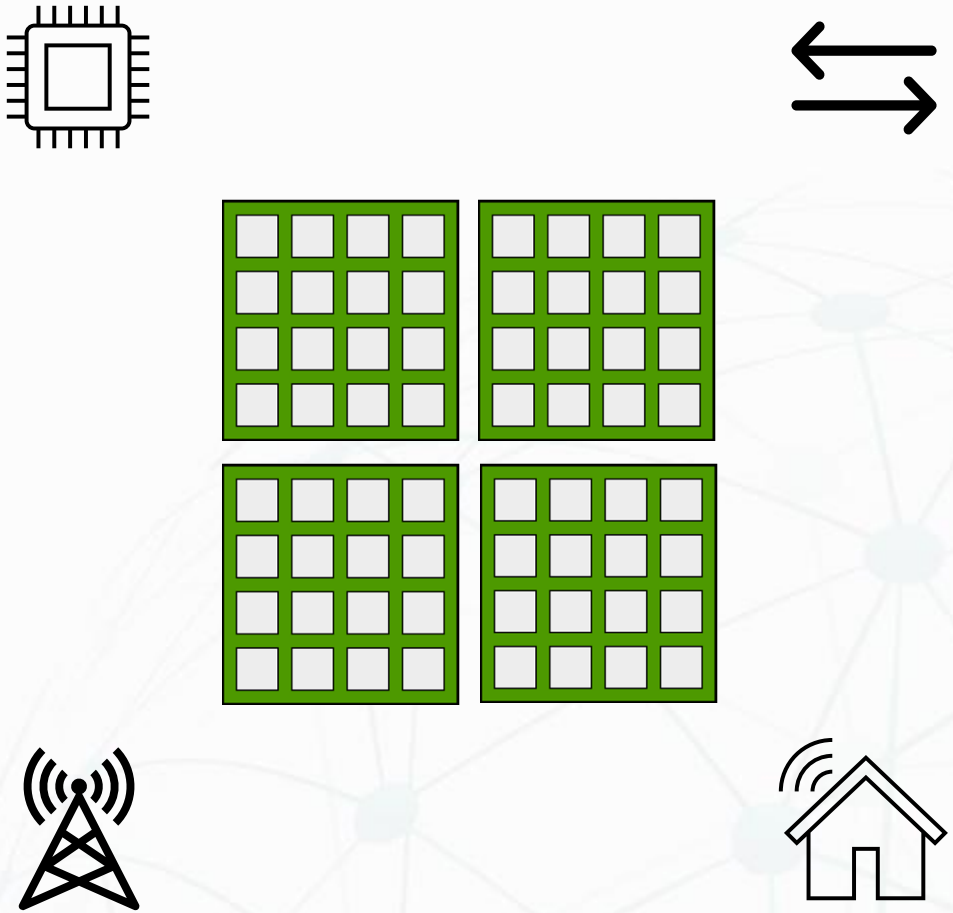
Design and Implementation

Communication Protocol Overview



Conclusion and Outlook

- RIS as one of the 6G enabler technologies
- A step towards modularity on passive RIS systems
- PCB implementation
- Experiment setups with USRP



THANK YOU

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DFKI Human Centric AI.