

Towards a Unified Framework for the Evaluation and Optimization of NoC Application Mapping Algorithms



Lucian Blaga University of Sibiu

Ciprian Radu, Lucian Vințan

Advanced Computer Architecture & Processing Systems Research Lab

<http://acaps.ulbsibiu.ro/research.php>

"Lucian Blaga" University of Sibiu, Romania

Introduction

- **Application mapping problem** = the topological placement of IPs onto Network-on-Chip tiles
- Application mapping algorithms use network performance metrics like bandwidth, latency and energy consumption to search for the optimal mapping
- The application mapping problem is connected with the **scheduling** and **routing** problems
- We propose using a **unified framework** for the *evaluation* and *optimization* of different application mapping algorithms, on multiple NoC designs

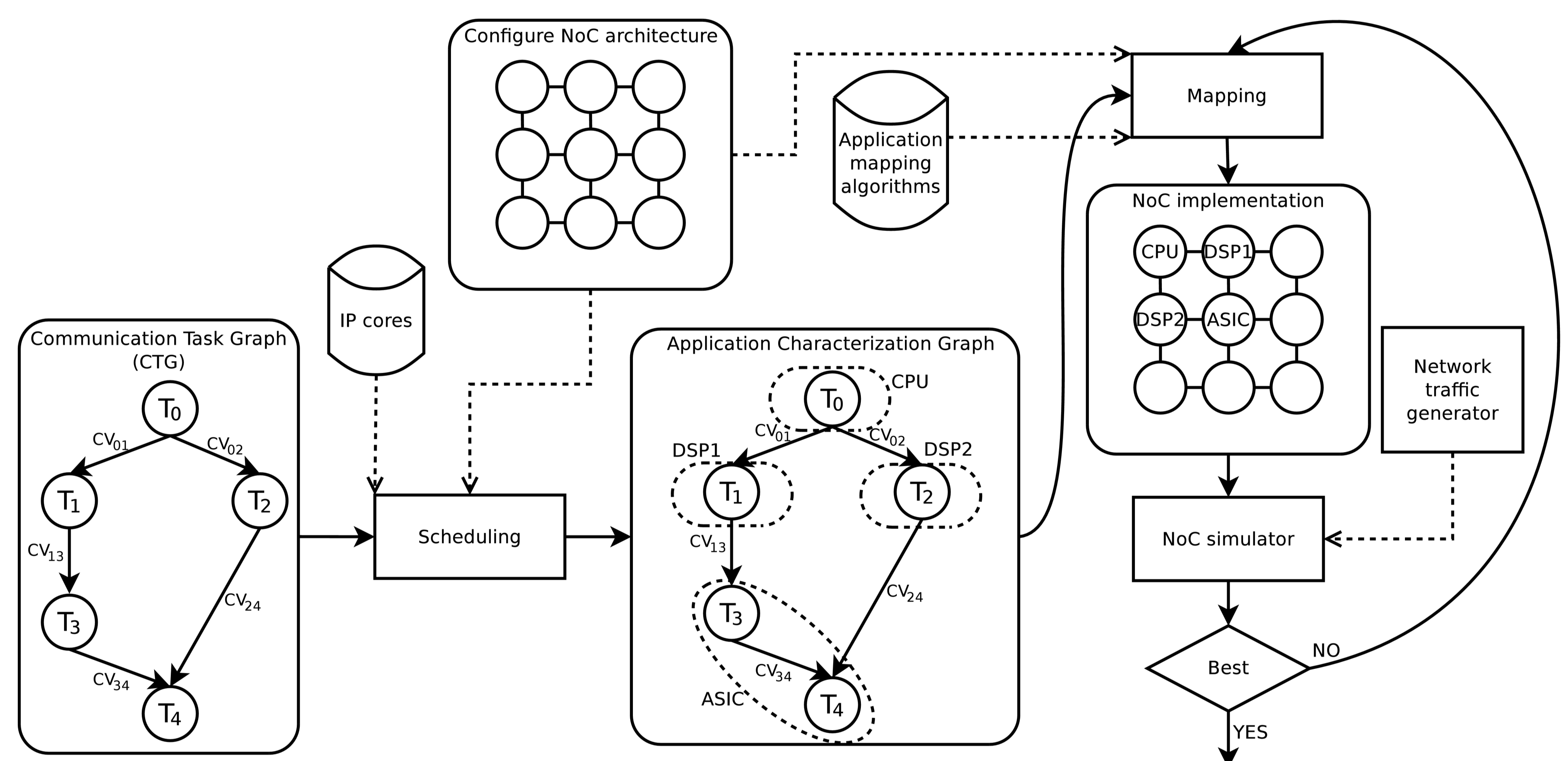
The Framework Design Flow

Main steps

- Obtain application's CTG
 - Randomly, using the TGFF tool
 - The E3S benchmarks suite
 - From real-world multithreaded applications, using the CETA too
- Configure the NoC architecture
- Scheduling (CTG → ACG)
- Mapping (with the selected algorithm)
- NoC simulation

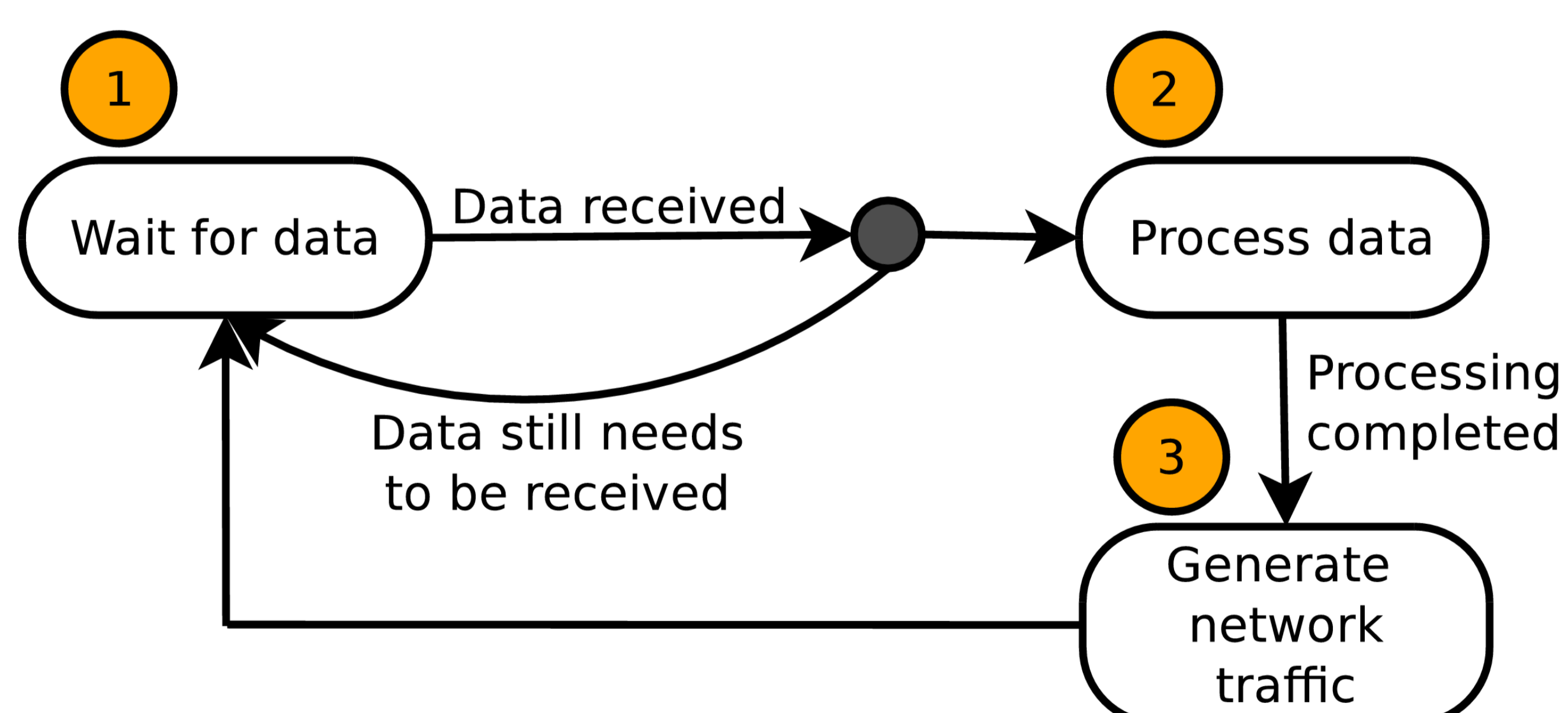
Advantages

- A common evaluation methodology of multiple application mapping algorithms
- Flexibility
- Scalability
- Network traffic from real applications



Executorial behavior

- Each NoC Processing Element is modeled as a Finite State Machine

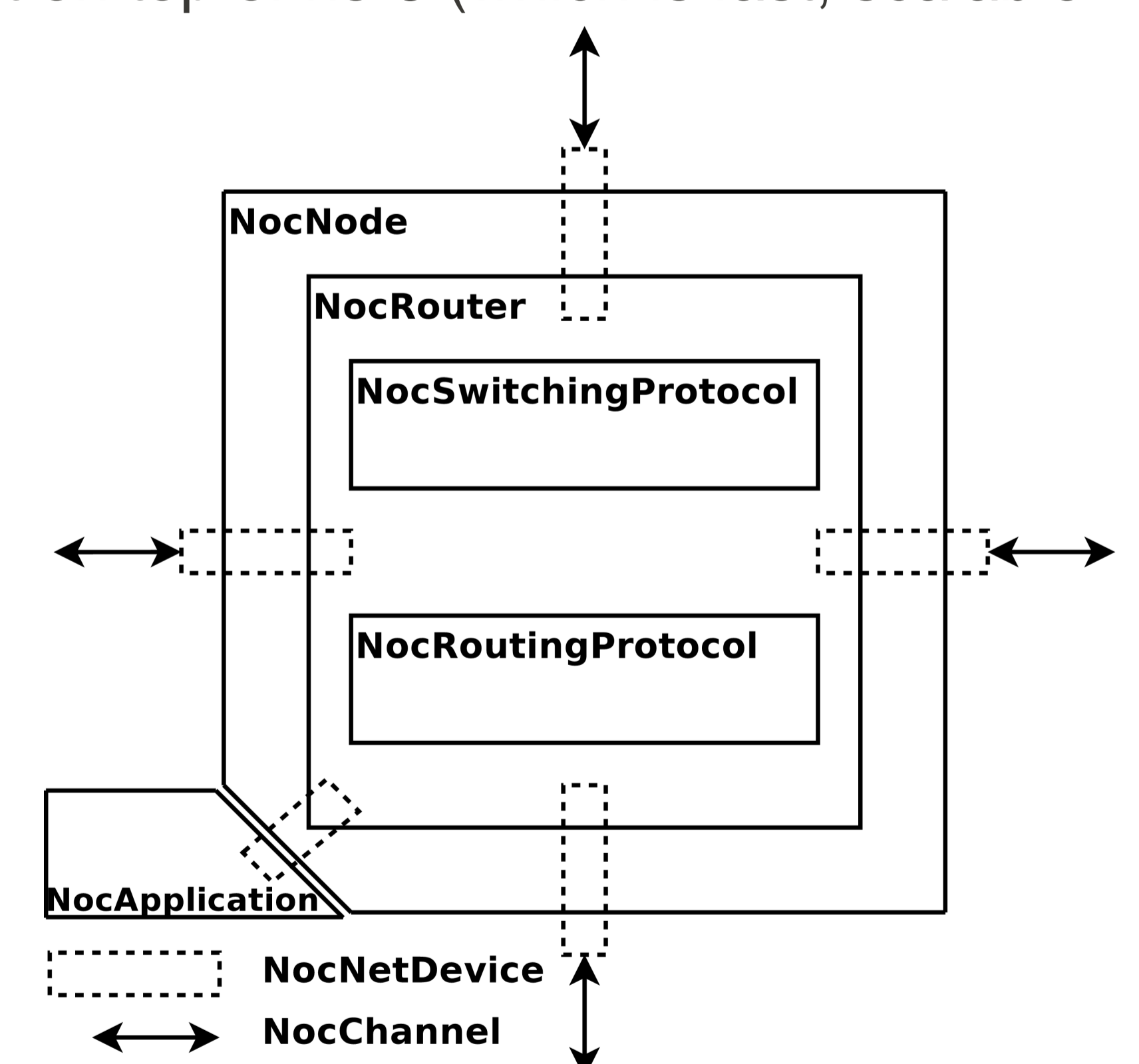


The ns-3 NoC Simulator

- Flexible NoC simulator, built on top of ns-3 (which is fast, scalable and memory efficient)

Parameters

- Packet size, injection rate and injection probability
- Buffer size
- Network size
- Switching mechanism (Store-and-Forward, Virtual Cut-Through, Wormhole)
- Routing protocol (XY, YX, SLB, SO)
- Topology (2D mesh, Irvine)



References

- [RV10] Ciprian Radu and Lucian Vințan. Optimizing application mapping algorithms for NoCs through a unified framework. In *Proceedings of the 9-th IEEE RoEduNet International Conference*, Sibiu, Romania, June 2010. IEEE Computer Society.
- [HM05] J. Hu and R. Marculescu. Communication and task scheduling of application-specific networks-on-chip. *IEE Proceedings - Computers and Digital Techniques*, 152(5):643, 2005.