Dataflow modeling of real-time memory controllers

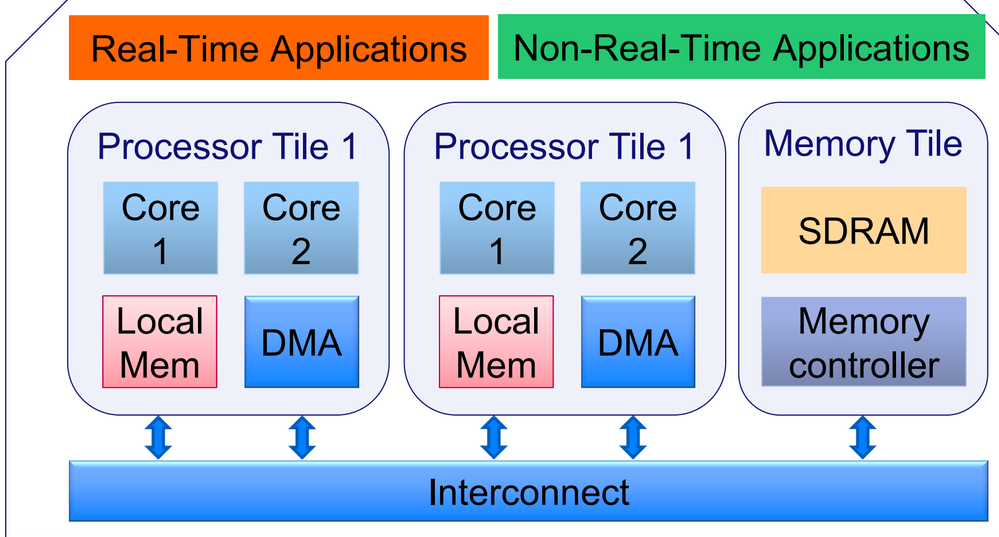
Dataflow Modeling of Real-Time Memory Controllers

Yonghui Li, Orlando Moreira, Benny Akesson, and Kees Goossens

1. Real-Time Applications & Multicore Systems

Various applications on modern multicore systems

- Some of them have real-time requirements, which are caused by the interaction with physical world
- Others are non-real-time, but must be responsive



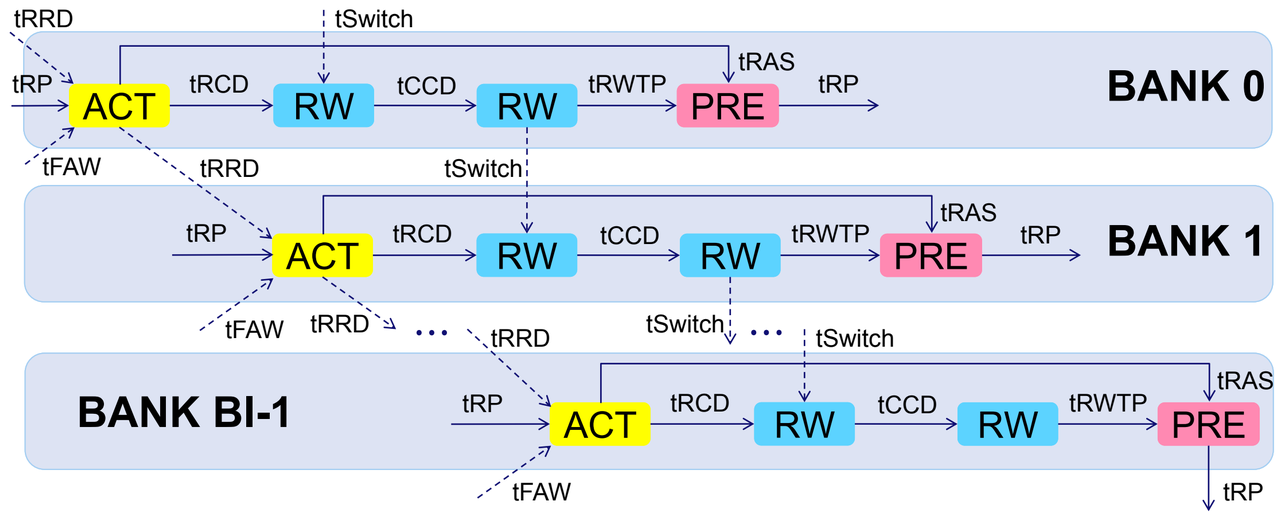
Multicore real-time system

- Has to guarantee the performance for real-time applications, even though resources are shared.
- The SDRAM is one of the most commonly shared resource, and the WCET of memory transactions is critical for designing a real-time system.

4. Command Scheduling Dependencies

Scheduling dependencies are caused by

- JEDEC timing constraints (constants) between commands
- Scheduling algorithm.

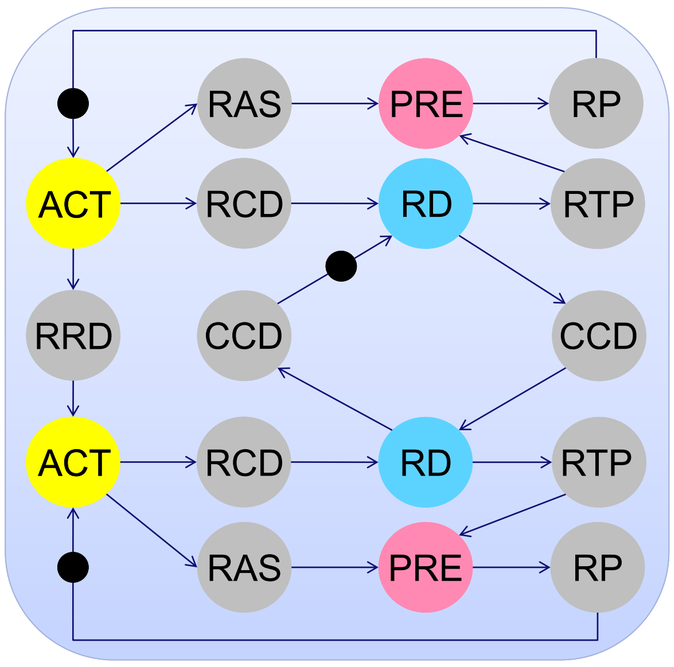


5. Dataflow Modeling of Scheduling Dependencies

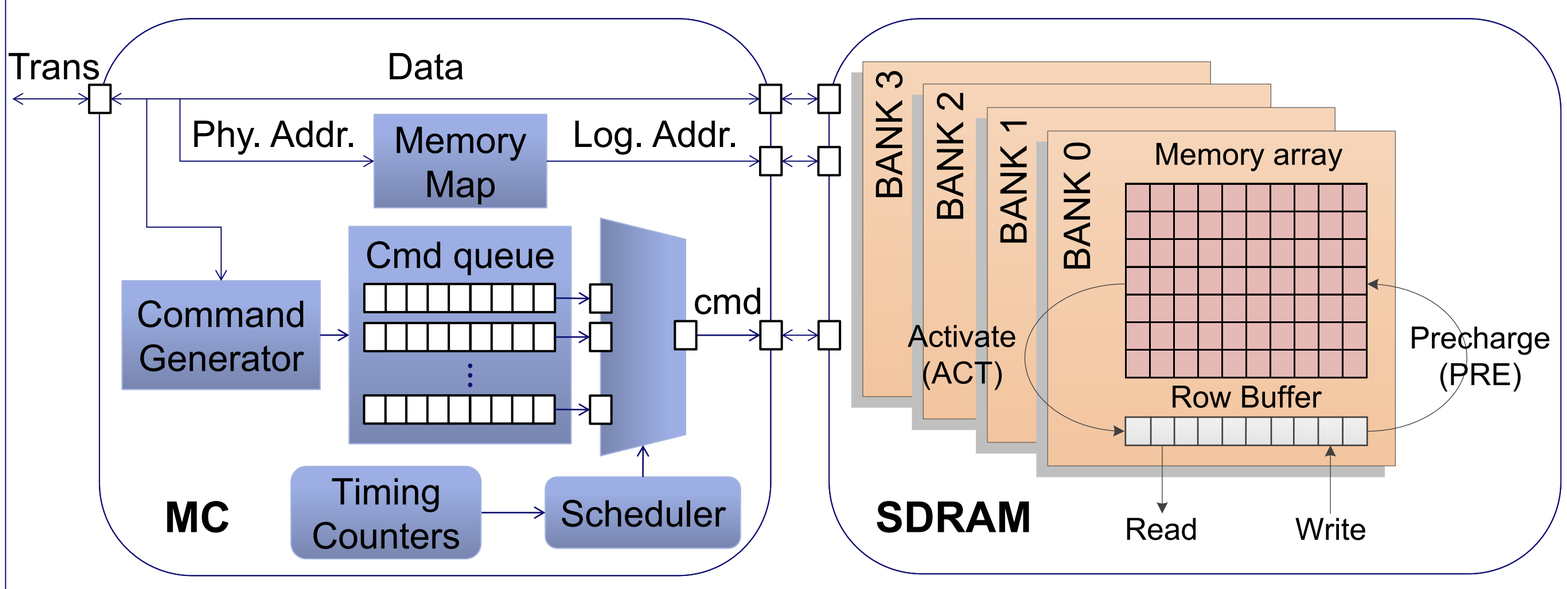
Memory command Scheduling is described by dataflow model

- Commands are captured by actors
- Timing constraints are molded by delay actors
- Scheduling dependencies are depicted by the edges between actors

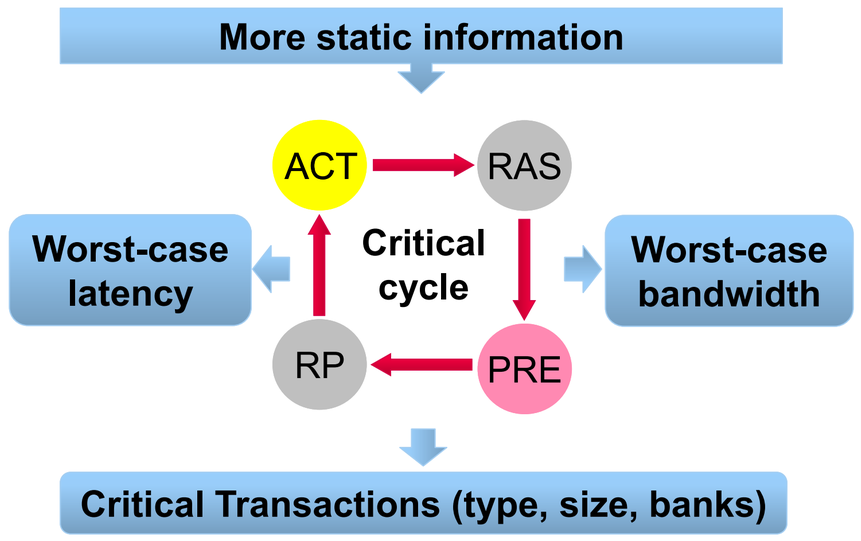
Single rate dataflow Graph for a Read Transaction



2. SDRAM & Memory Controller (MC)

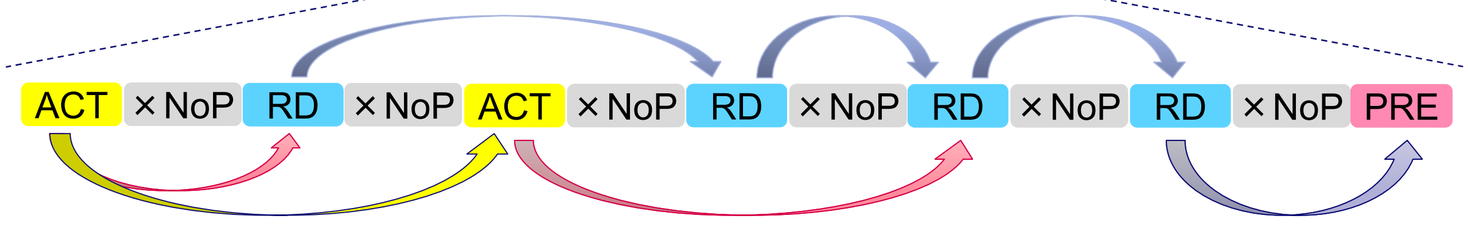


6. Worst-case analysis



3. From Transaction to Commands

E.g., a read transaction



A transaction is translated into a sequence of commands that are scheduled subject to the SDRAM timing constraints, which cause the dependencies between commands.

7. Contact

Name: Yonghui Li
Email: yonghui.li@tue.nl

Reference

[1] Yonghui Li, Benny Akesson, and Kees Goossens. ***Dynamic Command Scheduling for Real-Time Memory Controllers.*** *In Proc. ECRTS 2014.*