

**CS152**  
**Computer Architecture and Engineering**  
**Lecture 19**

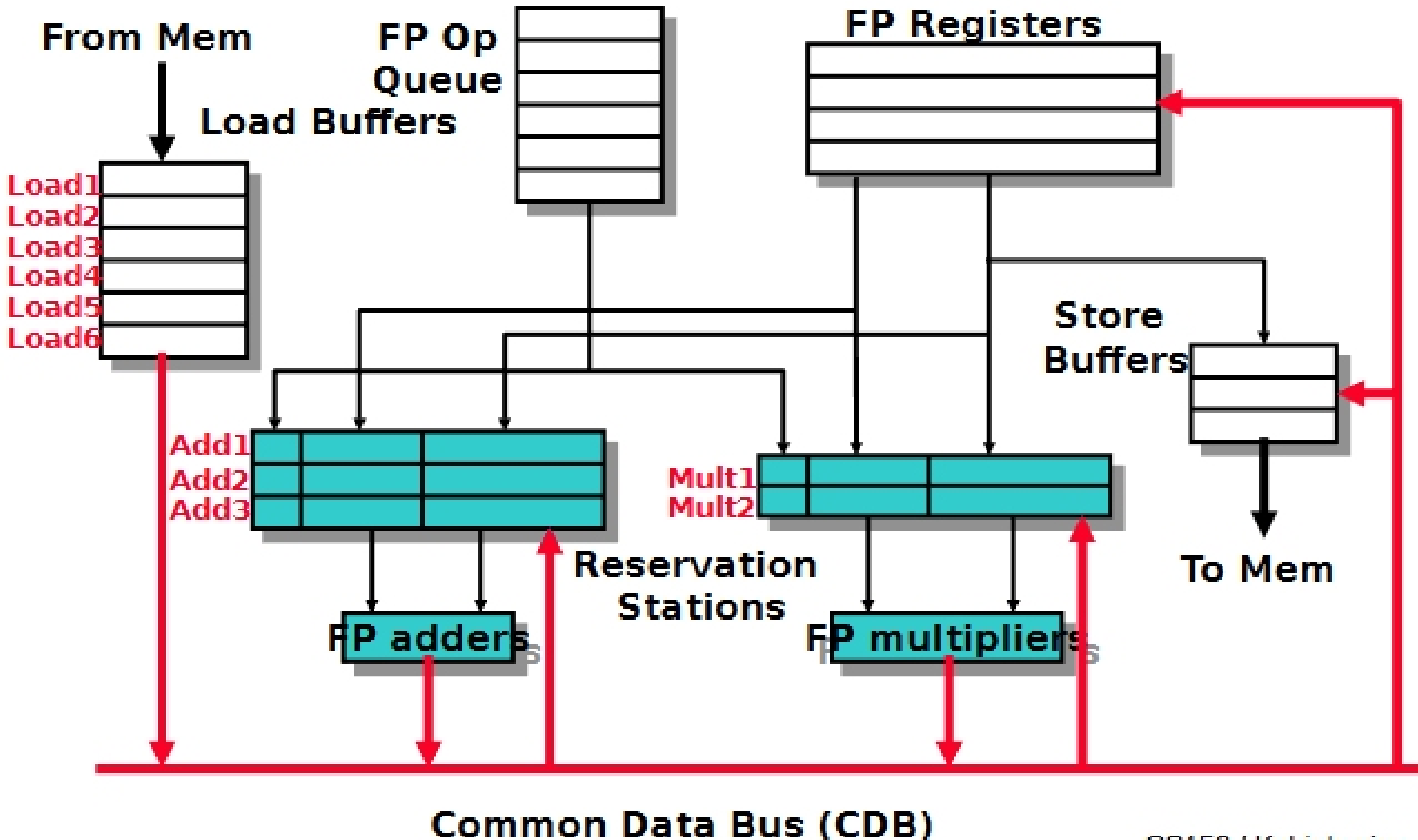
**Finish speculation**  
**(Branch Prediction)**

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**lecture slides: <http://www-inst.eecs.berkeley.edu/~cs152/>**

# Review: Tomasulo Organization



## Review: Tomasulo Architecture

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- **Reservations stations: renaming to larger set of registers + buffering source operands**
  - Prevents registers as bottleneck
  - Avoids WAR, WAW hazards of Scoreboard
  - Allows loop unrolling in HW
- **Not limited to basic blocks (integer units gets ahead, beyond branches)**
- **Dynamic Scheduling:**
  - Scoreboarding/Tomasulo
  - **In-order** issue, **out-of-order** execution, **out-of-order** commit
- **Branch prediction/speculation**
  - Regularities in program execution permit prediction of branch directions and data values
  - Necessary for wide superscalar issue