Pipelining

• What is it?

• Why does it improve performance?

• Basic data path

• Control

• What’s so hard about this?
• Structural Hazards
  • A component is required to do more than one thing at a time

• Control Hazards
  • Hey, I wanted to branch!
    
    ```
    beq  $t0, $t1, skip
    addi $t0, 1
    skip: lw $t1, N
    ```

• Data Hazards
  • dependencies
    • read-after-write (RAW)
      ```
      addi  $t0, $t0, 1
      add   $t2, $t0, $t1
      add   $t2, $t0, $t1
      ```
    • write-after-read (WAR)
    • write-after-write (WAW)