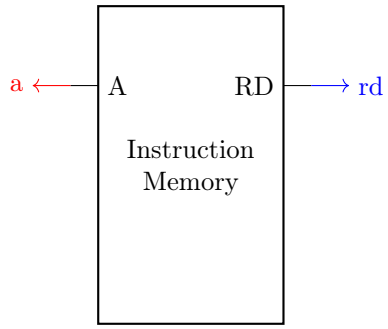
RISC-V Processor CircuiTi*k*Z Library

March 10, 2025

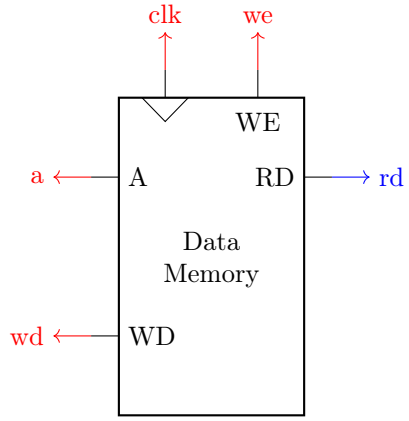
1 Components

1.1 Instruction Memory



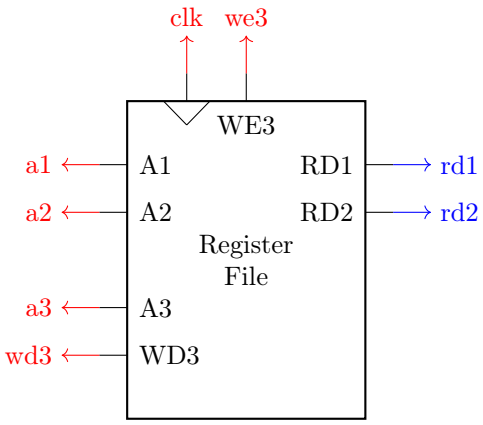

```
\begin{circuitikz}
  \node[instrmem, align=center] (comp) {
      Instruction\\Memory};

  \draw[->, red] (comp.a) -- ++(-.5, 0) node[
      left] {a};
  \draw[->, blue] (comp.rd) -- ++(.5, 0) node[
      right] {rd};
\end{circuitikz}
```

1.2 Data Memory



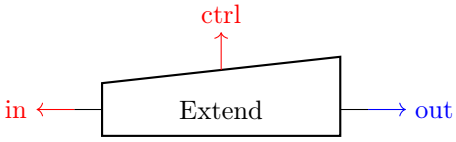

```
\begin{circuitikz}[]
  \node[datamem, align=center] (comp) {Data\\
      Memory};
  \draw[->, red] (comp.a) -- ++(-.5, 0) node[
      left] {a};
  \draw[->, red] (comp.wd) -- ++(-.5, 0) node[
      left] {wd};
  \draw[->, red] (comp.clk) -- ++(0, .5) node[
      above] {clk};
  \draw[->, red] (comp.we) -- ++(0, .5) node[
      above] {we};
  \draw[->, blue] (comp.rd) -- ++(.5, 0) node[
      right] {rd};
\end{circuitikz}
```

1.3 Register File



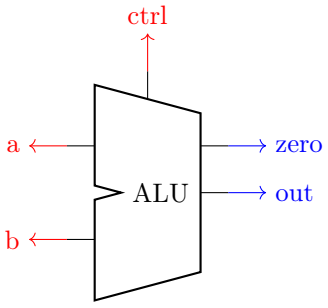

```
\begin{circuitikz}[]
  \node[regfile, align=center] (comp) {
      Register\\File};
  \draw[->, red] (comp.a1) -- ++(-.5, 0)
       node[left] {a1};
  \draw[->, red] (comp.a2) -- ++(-.5, 0)
       node[left] {a2};
  \draw[->, red] (comp.a3) -- ++(-.5, 0)
       node[left] {a3};
  \draw[->, red] (comp.wd3) -- ++(-.5,
      0) node[left] {wd3};

  \draw[->, red] (comp.clk) -- ++(0, .5)
       node[above] {clk};
  \draw[->, red] (comp.we3) -- ++(0, .5)
       node[above] {we3};
  \draw[->, blue] (comp.rd1) -- ++(.5,
      0) node[right] {rd1};
  \draw[->, blue] (comp.rd2) -- ++(.5,
      0) node[right] {rd2};
\end{circuitikz}
```

1.4 Extend Unit



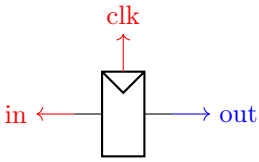

```
\begin{circuitikz}[]
  \node[extend, align=center] (comp) {
      Extend};
  \draw[->, red] (comp.in) -- ++(-.5, 0)
      node[left] {in};
  \draw[->, red] (comp.ctrl) -- ++(0, .5)
      node[above] {ctrl};
  \draw[->, blue] (comp.out) -- ++(.5, 0)
      node[right] {out};
\end{circuitikz}
```

1.5 Arithmetic Logic Unit



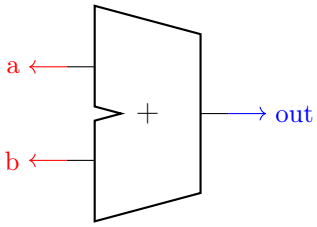

```
\begin{circuitikz}[]
  \node[alu, align=center] (comp) {ALU};
  \draw[->, red] (comp.a) -- ++(-.5, 0) node[left] {
      a};
  \draw[->, red] (comp.b) -- ++(-.5, 0) node[left] {
      b};
  \draw[->, red] (comp.ctrl) -- ++(0, .5) node[above
      ] {ctrl};
  \draw[->, blue] (comp.out) -- ++(.5, 0) node[right
      ] {out};
  \draw[->, blue] (comp.zero) -- ++(.5, 0) node[
      right] {zero};
\end{circuitikz}
```

1.6 Register



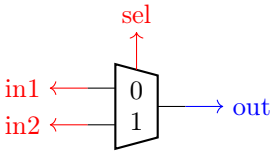

```
\begin{circuitikz}[]
  \node[reg, align=center] (comp) {};
  \draw[->, red] (comp.in) -- ++(-.5, 0) node[left] {in};
  \draw[->, red] (comp.clk) -- ++(0, .5) node[above] {clk
      };
  \draw[->, blue] (comp.out) -- ++(.5, 0) node[right] {out
      };
\end{circuitikz}
```

1.7 Adder



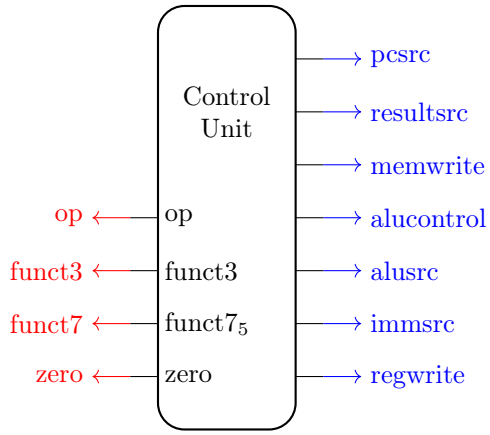

```
\begin{circuitikz}[]
  \node[adder, align=center] (comp) {};
  \draw[->, red] (comp.a) -- ++(-.5, 0) node[left] {a
      };
  \draw[->, red] (comp.b) -- ++(-.5, 0) node[left] {b
      };
  \draw[->, blue] (comp.out) -- ++(.5, 0) node[right]
       {out};
\end{circuitikz}
```

1.8 Multiplexer




```
\begin{circuitikz}[]
  \node[mux, align=center] (comp) {};
  \draw[->, red] (comp.in1) -- ++(-.5, 0) node[left] {in
      1};
  \draw[->, red] (comp.in2) -- ++(-.5, 0) node[left] {in
      2};
  \draw[->, red] (comp.sel) -- ++(0, .5) node[above] {sel
      };
  \draw[->, blue] (comp.out) -- ++(.5, 0) node[right] {
      out};
\end{circuitikz}
```

1.9 Single-Cycle Control Unit




```
\begin{circuitikz}[]
   \node[ctrlunitsc, align=center] (comp)
        {Control\\Unit};
   \draw[->, red] (comp.op) -- ++(-.5, 0)
        node[left] {op};
   \draw[->, red] (comp.funct3) --
       ++(-.5, 0) node[left] {funct3};
   \draw[->, red] (comp.funct7) --
       ++(-.5, 0) node[left] {funct7};
   \draw[->, red] (comp.zero) -- ++(-.5,
       0) node[left] {zero};

   \draw[->, blue] (comp.pcsrc) -- ++(.5,
        0) node[right] {pcsrc};
   \draw[->, blue] (comp.resultsrc) --
       ++(.5, 0) node[right] {resultsrc};
   \draw[->, blue] (comp.memwrite) --
       ++(.5, 0) node[right] {memwrite};
   \draw[->, blue] (comp.alucontrol) --
       ++(.5, 0) node[right] {alucontrol
       };
   \draw[->, blue] (comp.alusrc) --
       ++(.5, 0) node[right] {alusrc};
   \draw[->, blue] (comp.immsrc) --
       ++(.5, 0) node[right] {immsrc};
   \draw[->, blue] (comp.regwrite) --
       ++(.5, 0) node[right] {regwrite};
\end{circuitikz}
```

2 Single-Cycle RISC-V Processor