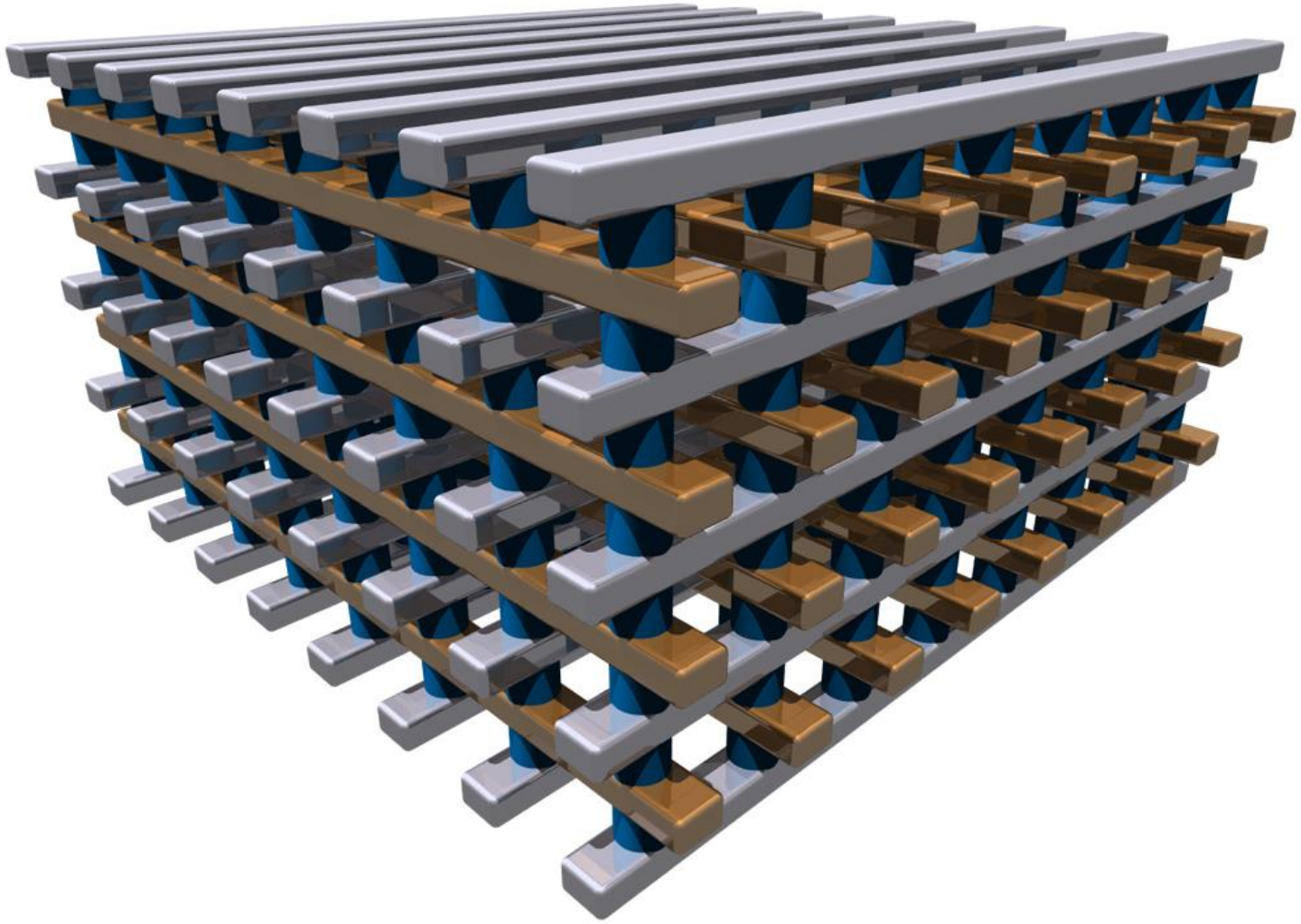
ReRAM ASIC Compute Crossbar



Sddec24-13

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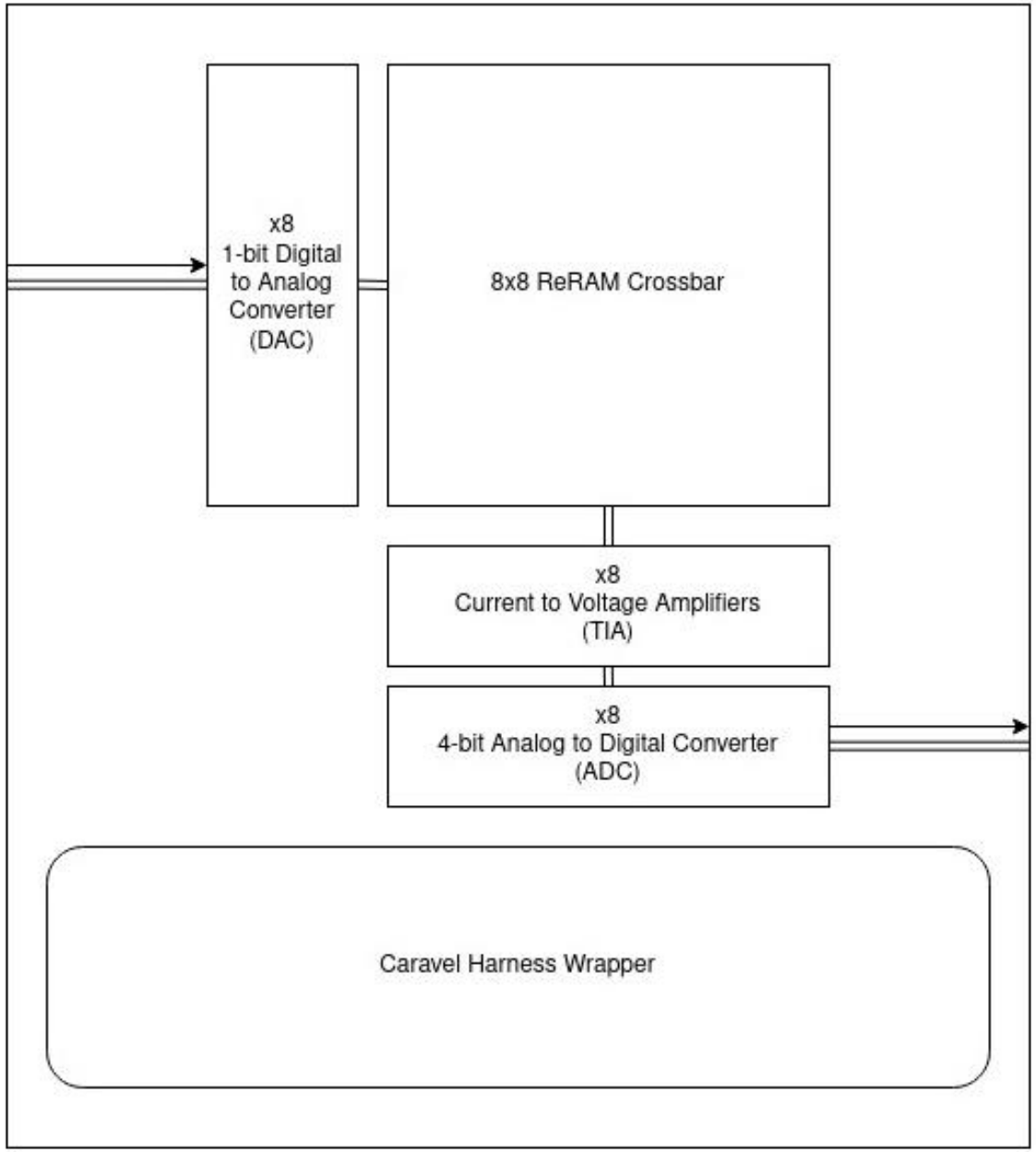
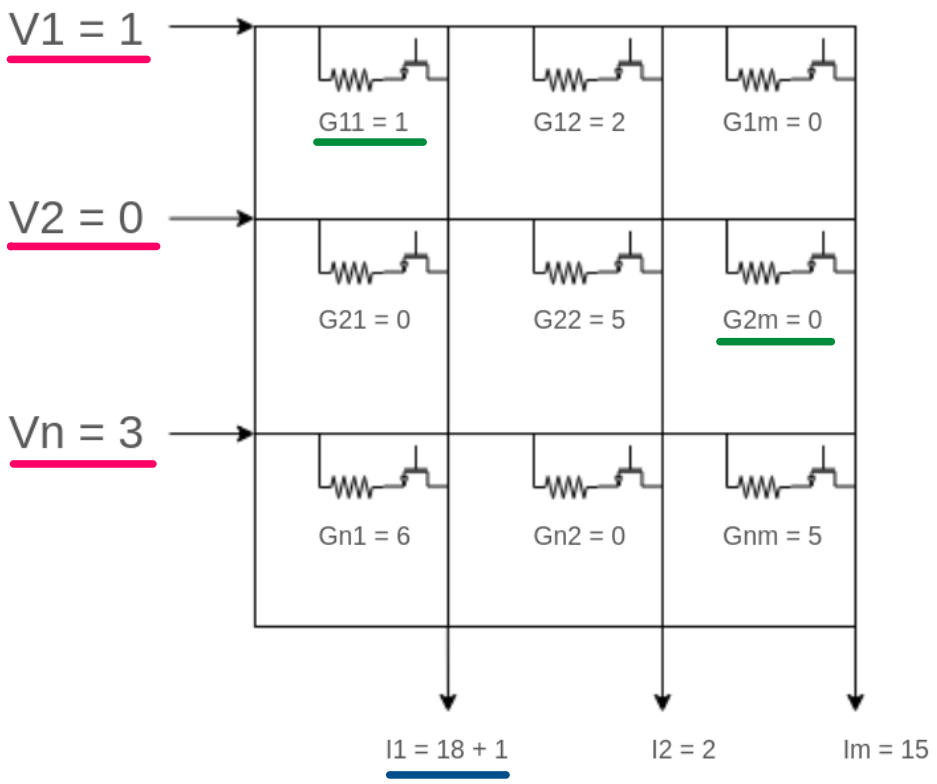
Project Overview

- Design a test vehicle for a Resistive Random-Access Memory (ReRAM) crossbar for proof of concept
- Utilise open-source design tools
- Submit fabrication application Efabless shuttle program
- Create bring up plan to test device
- Create documentation for open-source tools for future users



Crossbar Compute Operation



$$\begin{bmatrix} V1 & V2 & Vn \end{bmatrix} \cdot \begin{bmatrix} G11 & G12 & G1m \\ G21 & G22 & G2m \\ Gn1 & Gn2 & Gnm \end{bmatrix} = \begin{bmatrix} I1 \\ I2 \\ Im \end{bmatrix}$$

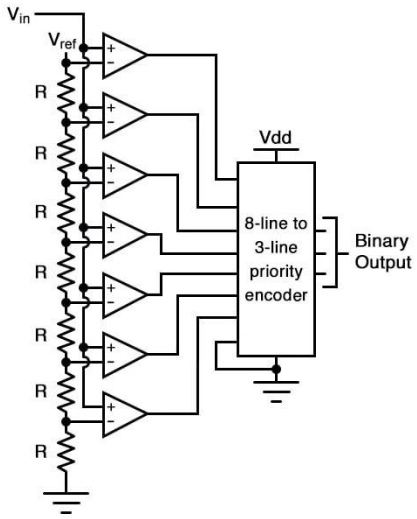
- Compute in memory
- Eliminates data transfer to a digital ALU

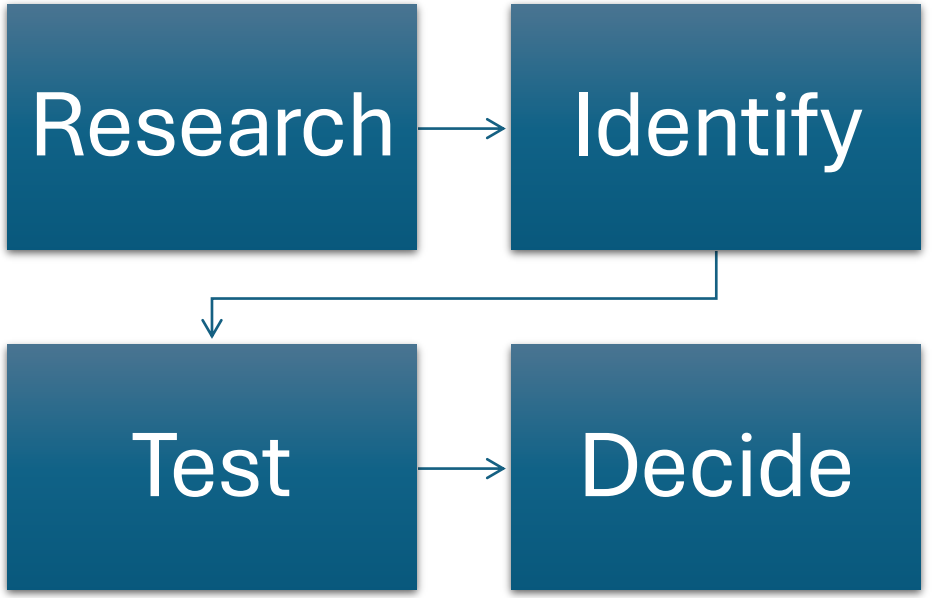
Ideation

- Analog to Digital Converter
- Current to Voltage Amplifier
- ReRAM interface
- ReRAM architecture

ADC design

- Different types of ADC architectures
- Identified Pros and Cons of common architectures
- Why we chose flash over other types
- Speed, Power, Area





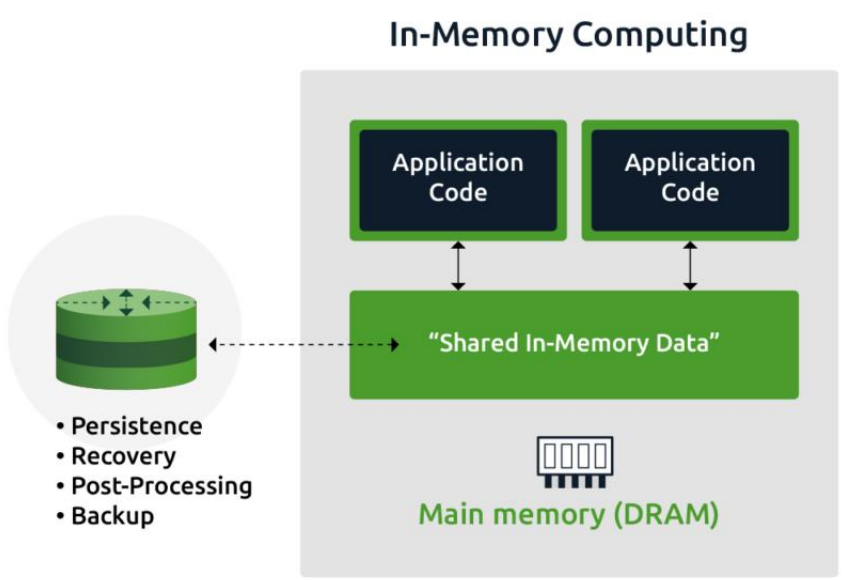
Market Research

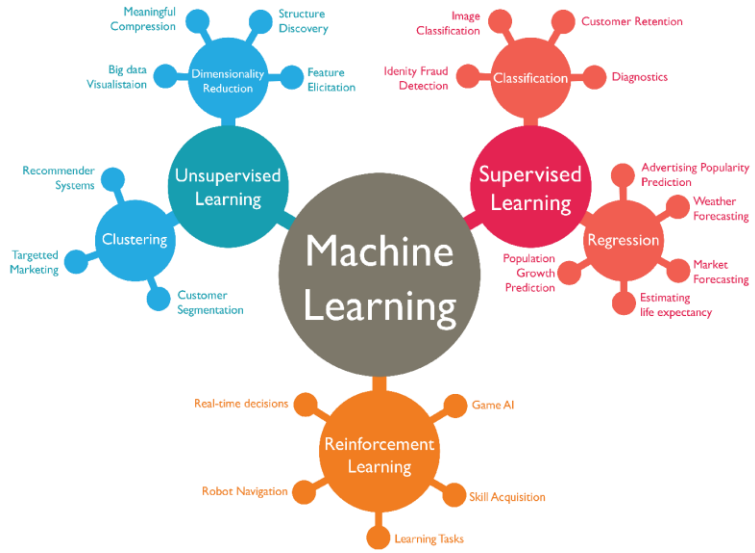
- Pros and cons
  - High density
  - Low power consumption
  - Non-volatile

  But…
  - Low lifespan
  - Complex fabrication process
- Useful in…
  - Machine learning
  - Automotive applications

Our Use

- Research oriented
  - In memory computation
- Co-curricular end goal
- Sidestep Von Neumann bottleneck





Questions?

Image Citations

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