CS250 - Computer Organization and Architecture

nPower Processor in TL-Verilog - HDL Assignment

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Content

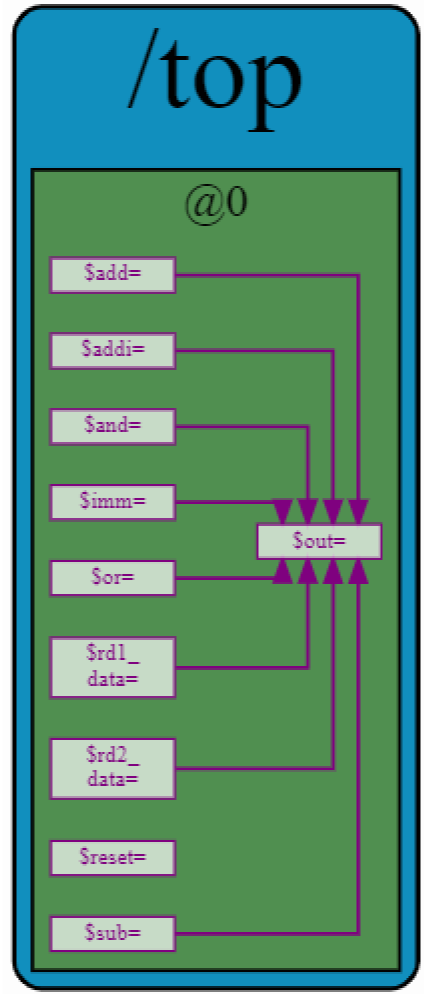
64-bit Integer ALU Design

The 64-bit ALU performs can perform following operations to two 64-bit operands:

1. and : &&
2. or : ||
3. addition : +
4. subtraction : -

This 64-bit ALU requires the output from the ALU control unit as input which helps in identifying the operation to be done between the two operands.

Block Diagram



ALU Control

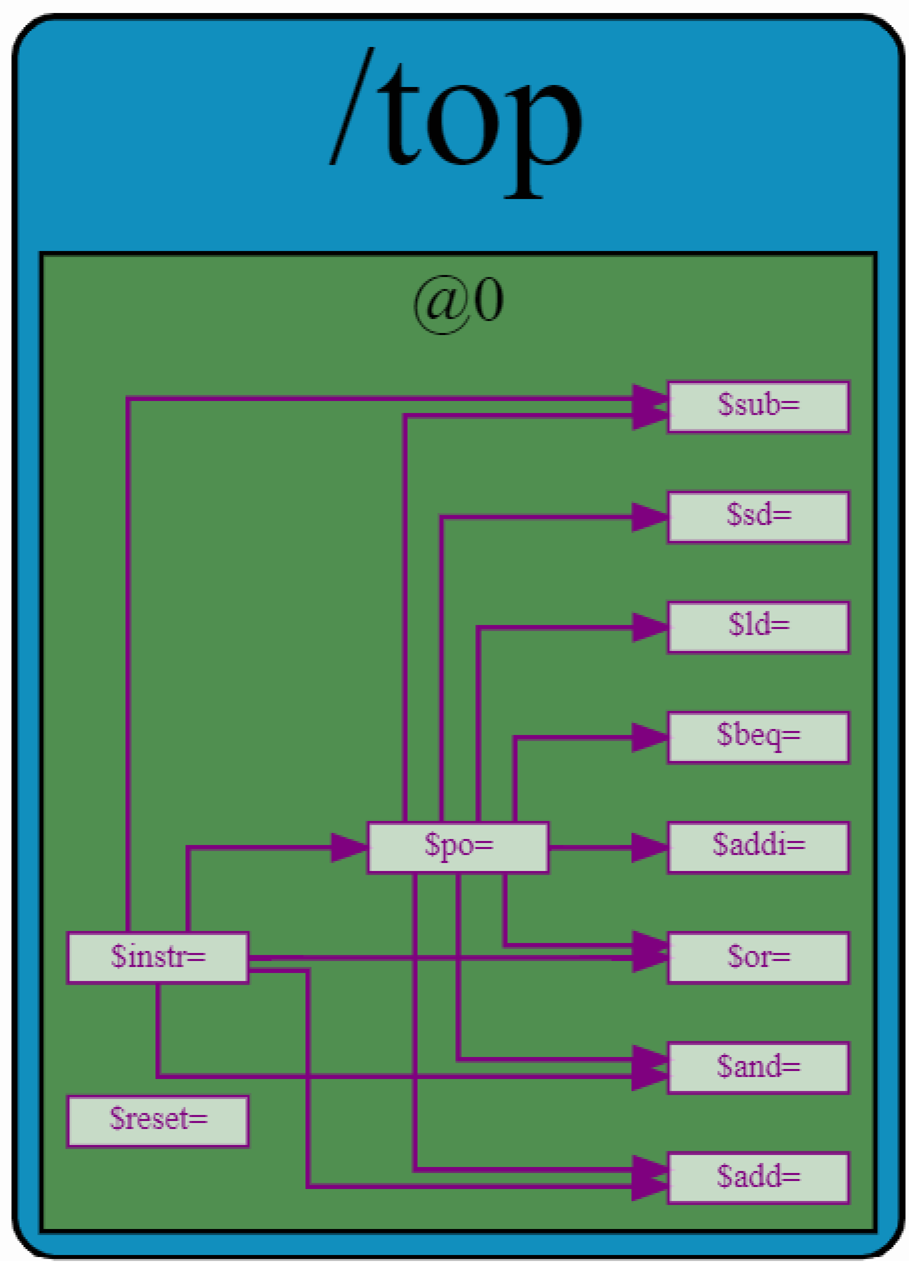
As the name suggests it controls the ALU designed above.

It informs the operation to be done by the ALU for the corresponding instruction.

Following table shows the ALU operation for the corresponding instruction:

Instruction	Operation by ALU
add	addition
addi	addition
sub	subtraction
ld	addition
sd	addition
and	bitwise and
or	bitwise or

Block Diagram



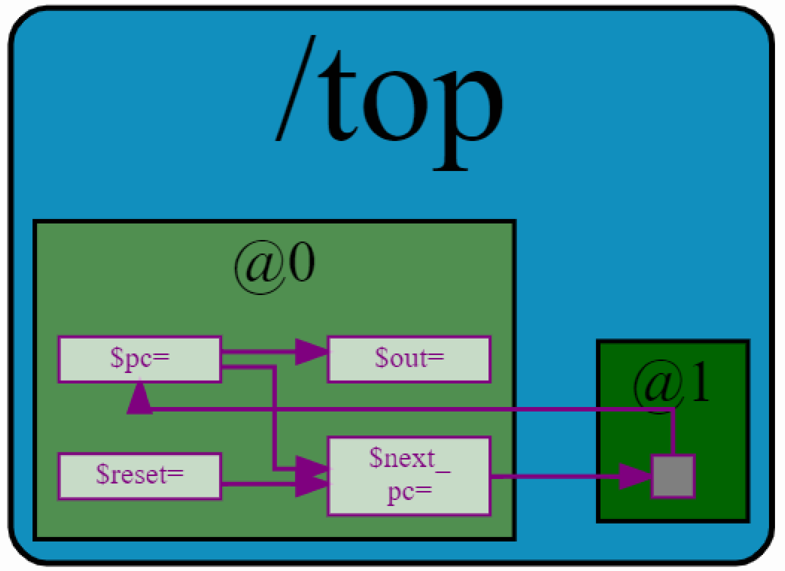
Instruction Fetch Hardware

As the name suggests it reads the instruction from the memory.

Based on the value of PC it reads/fetches the corresponding instruction in memory at PCth location in the memory.

It updates PC value to PC + 4 as default.
If the reset value is set to 1 then it resets the PC value such that it reads the 1st instruction.

Block Diagram



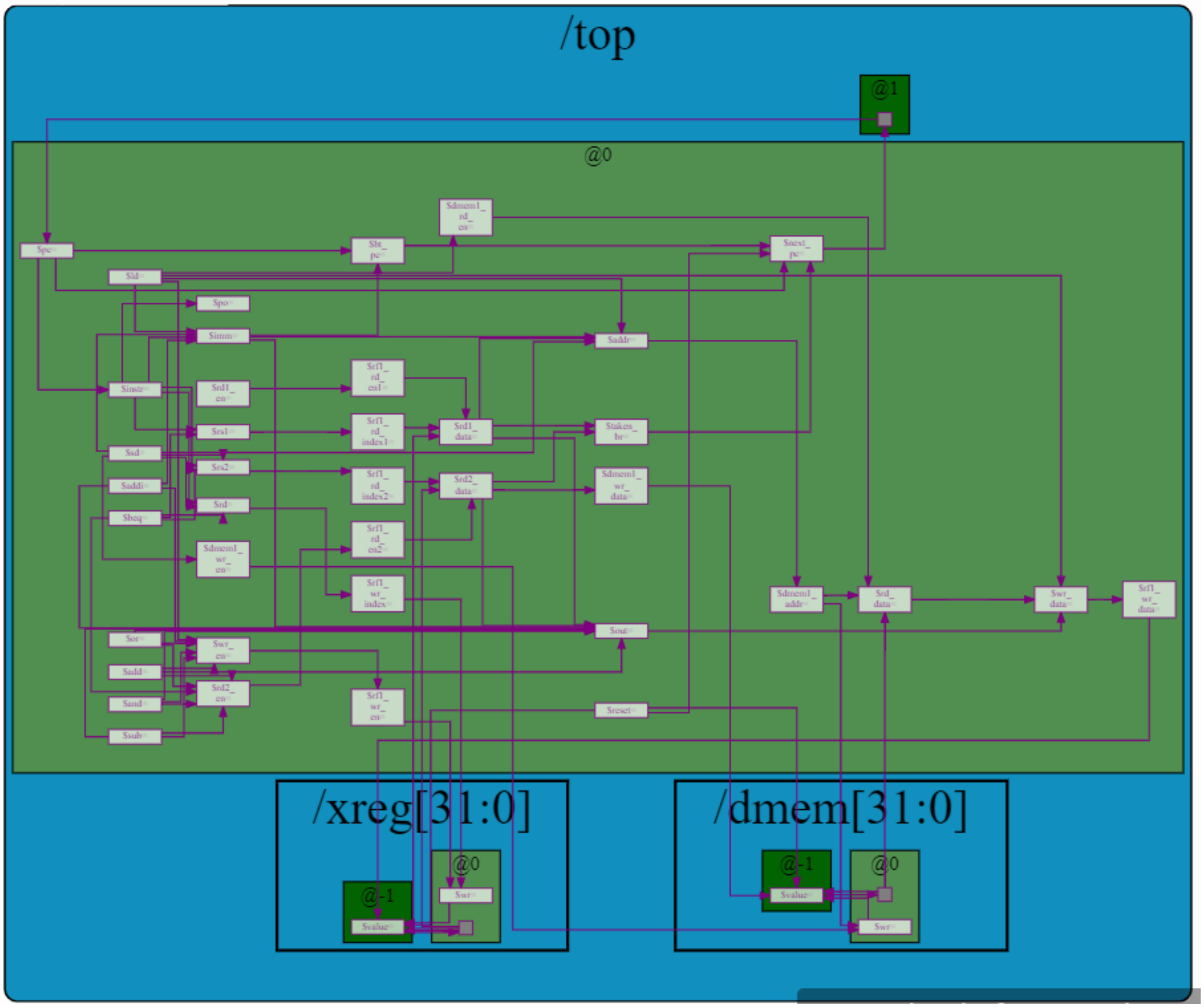
Datapath

Now this code can execute a complete instruction.

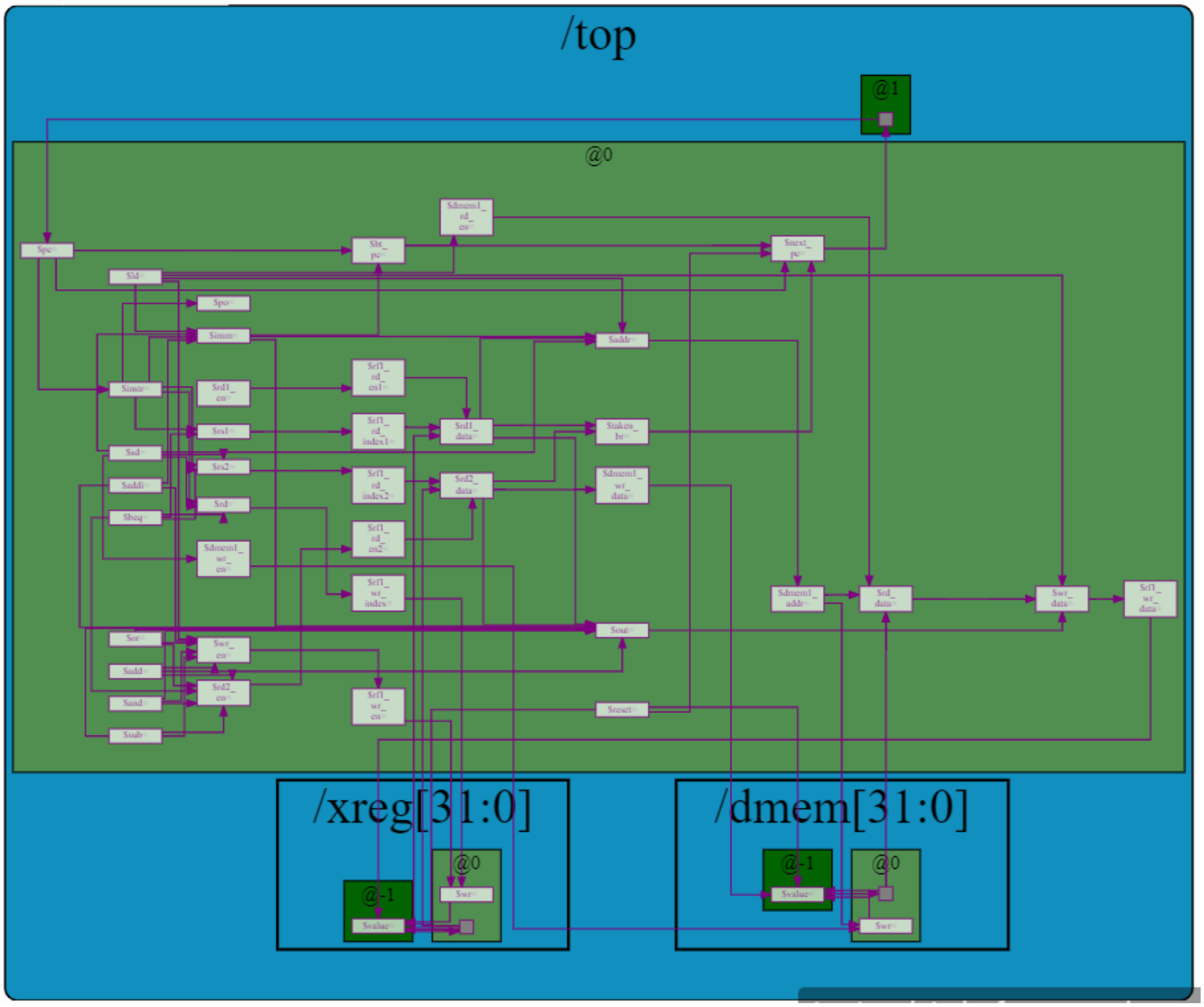
Here the control signals are hard coded accordingly for a particular instruction to get executed.

Now the block diagrams for each instruction is as follows:

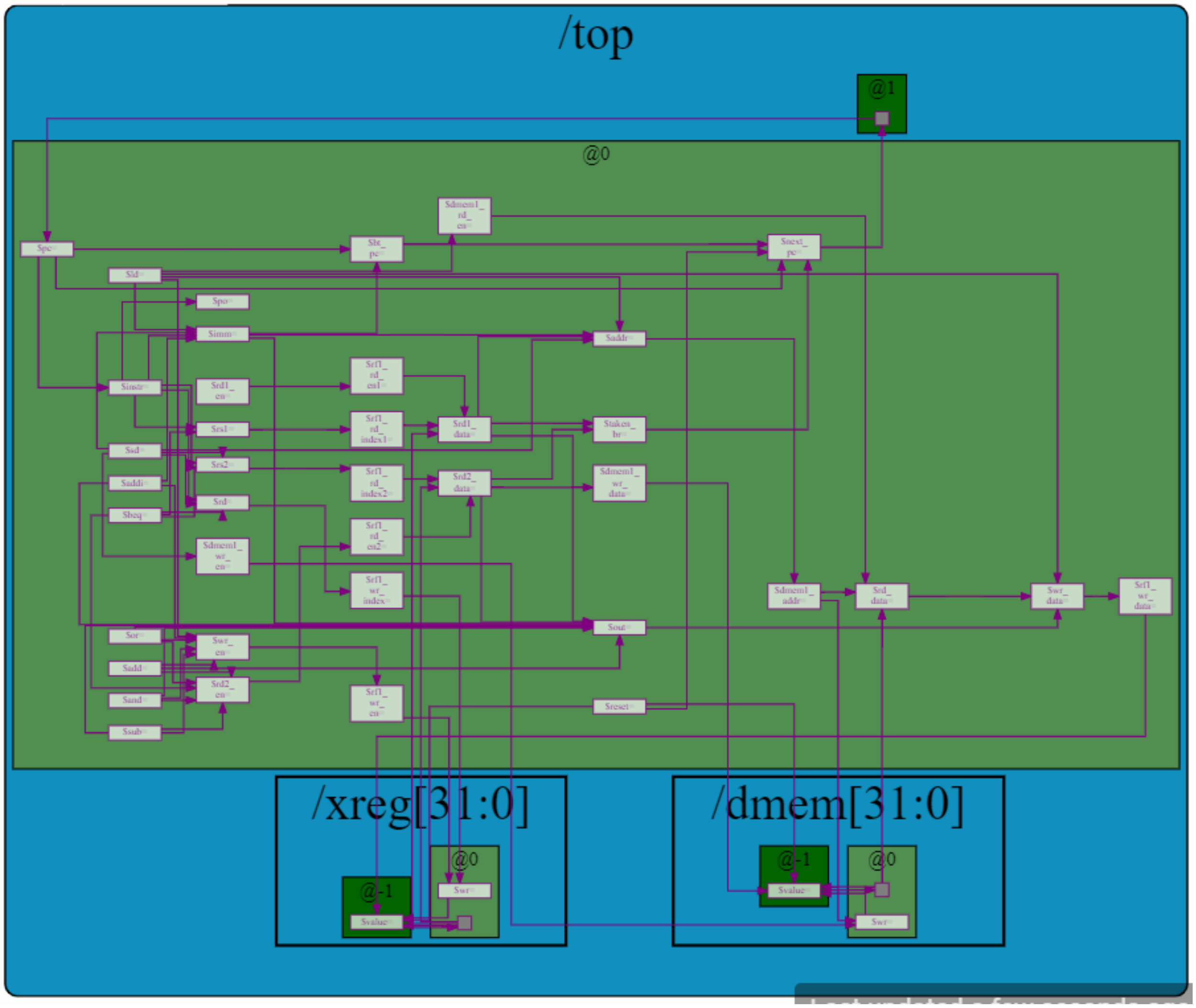
add instruction



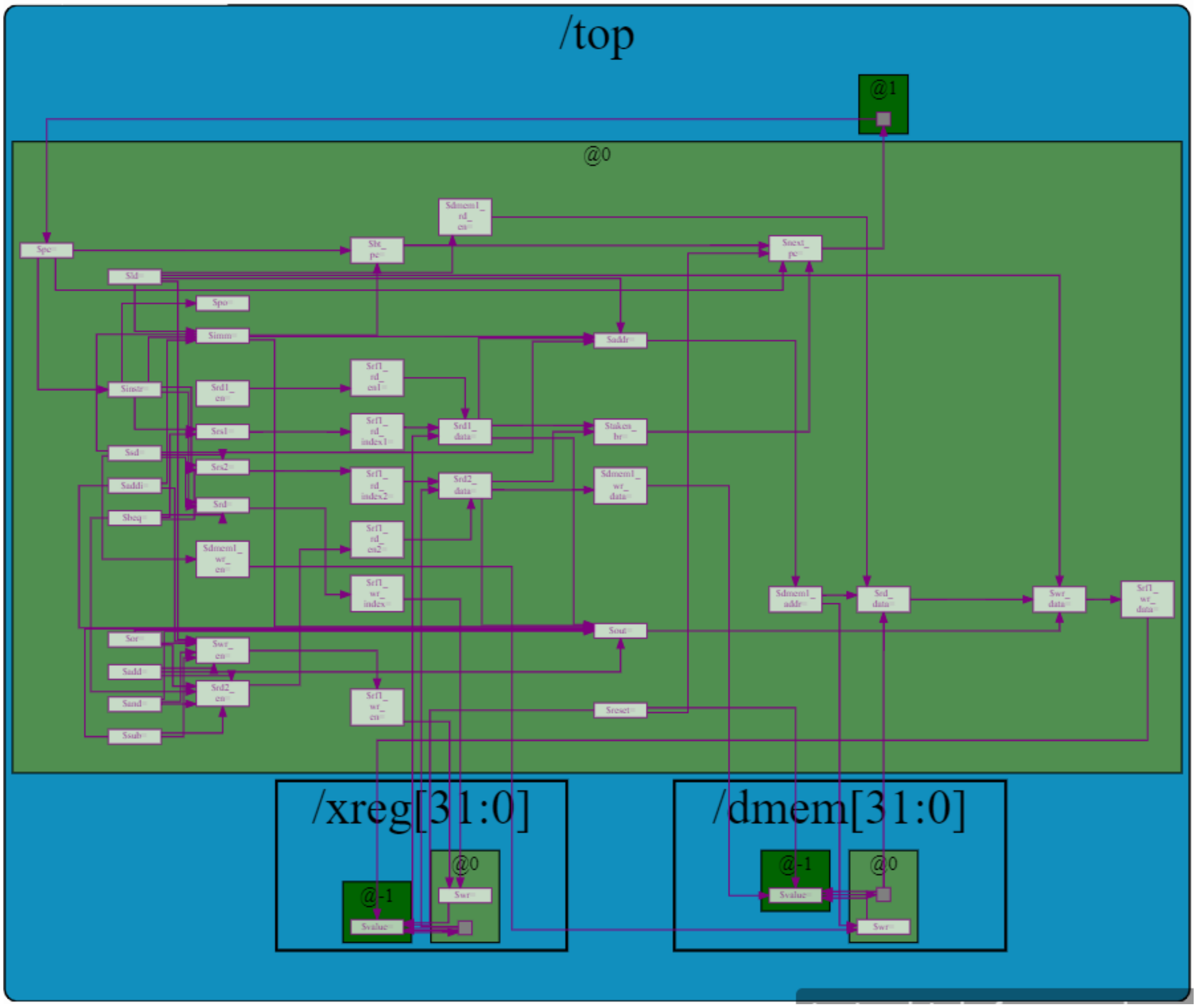
addi instruction



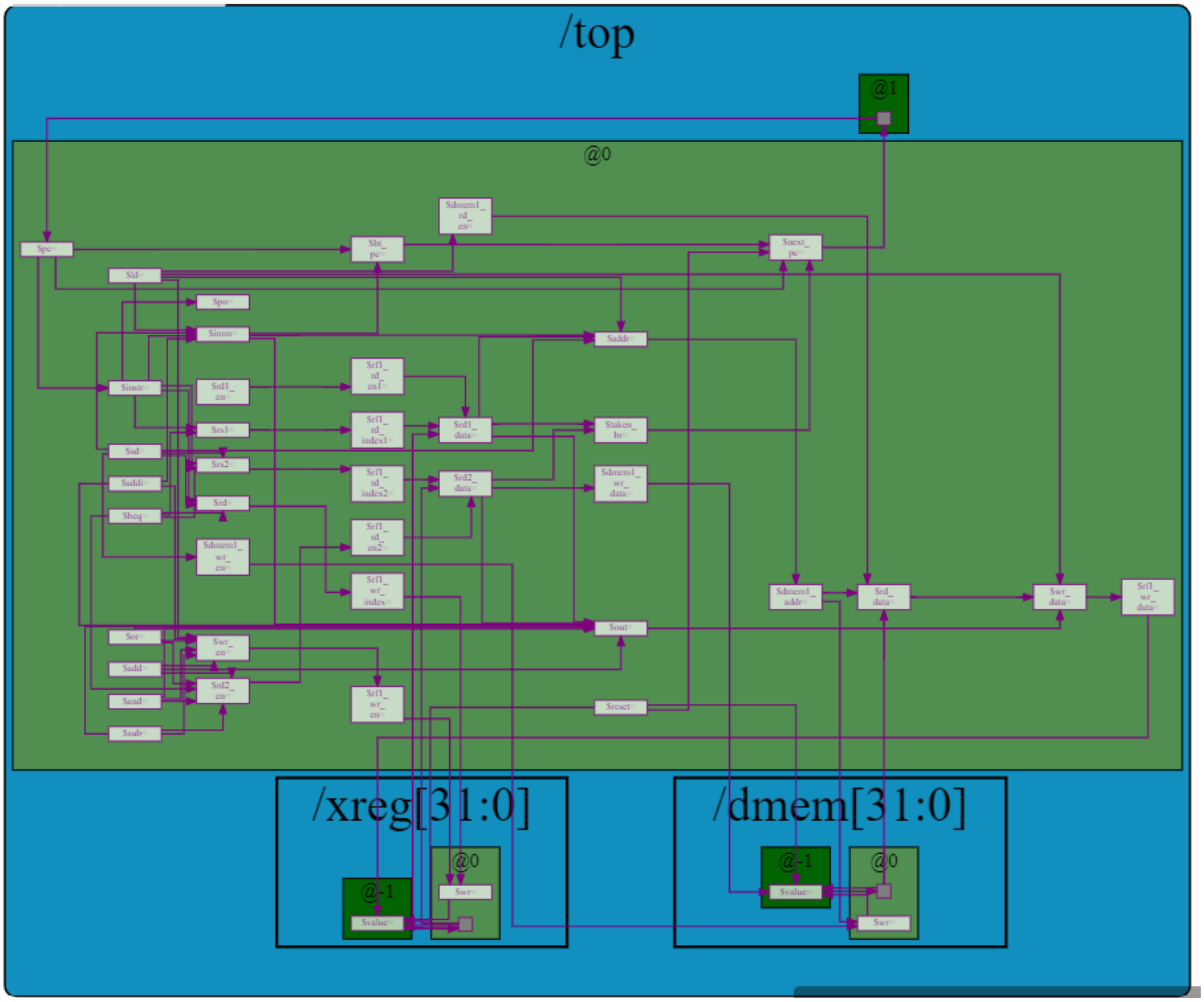
and instruction



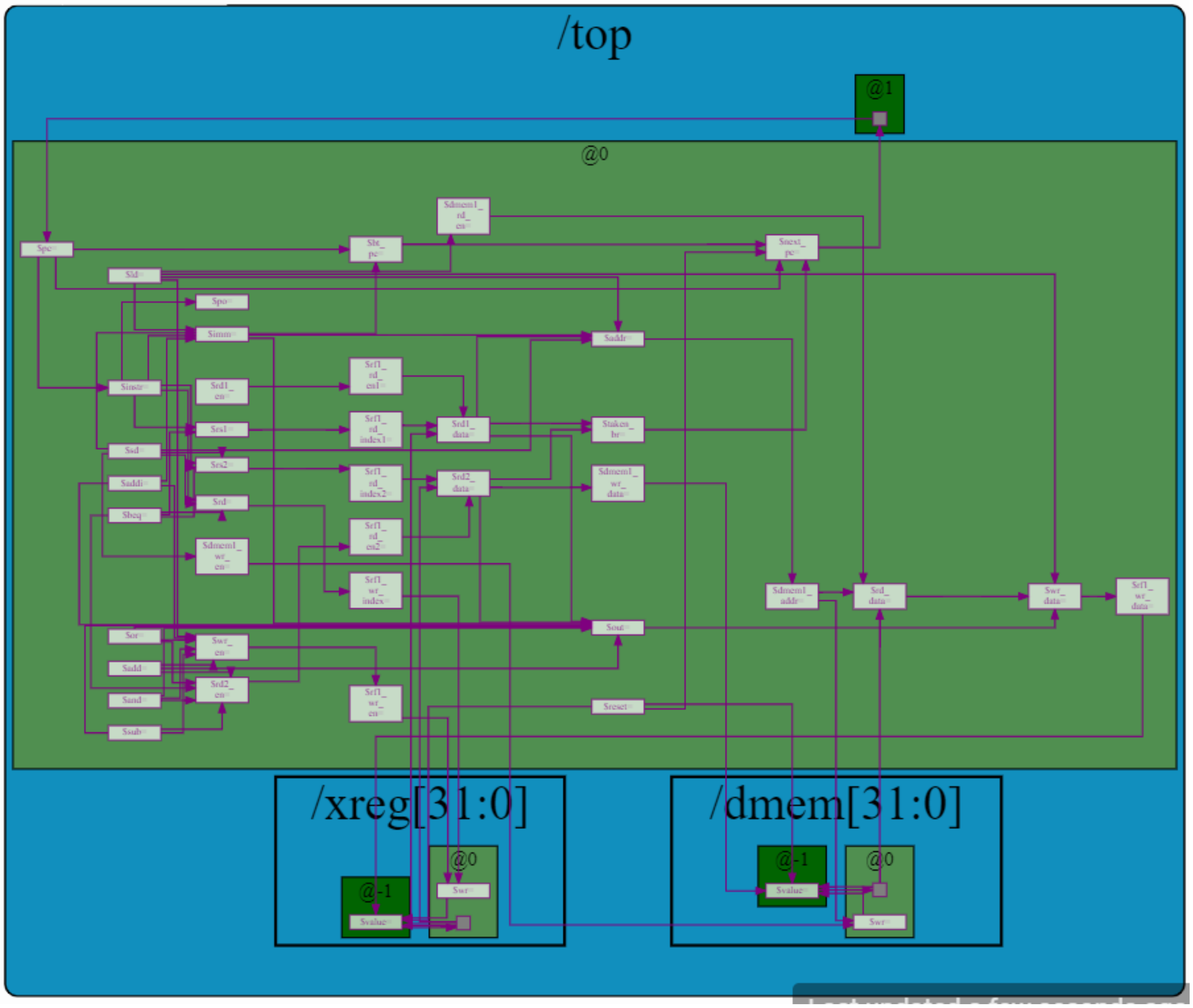
beq instruction



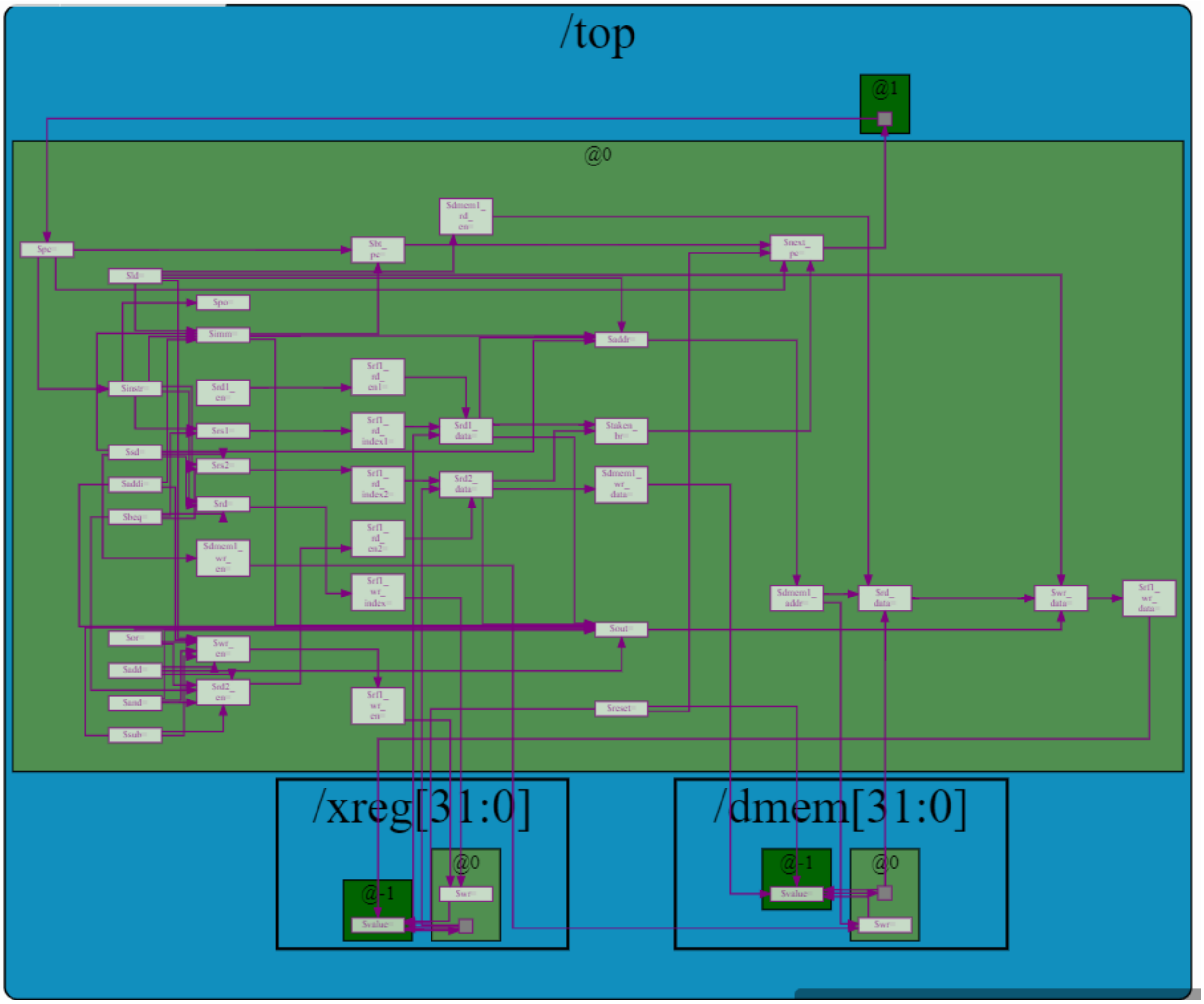
load instruction



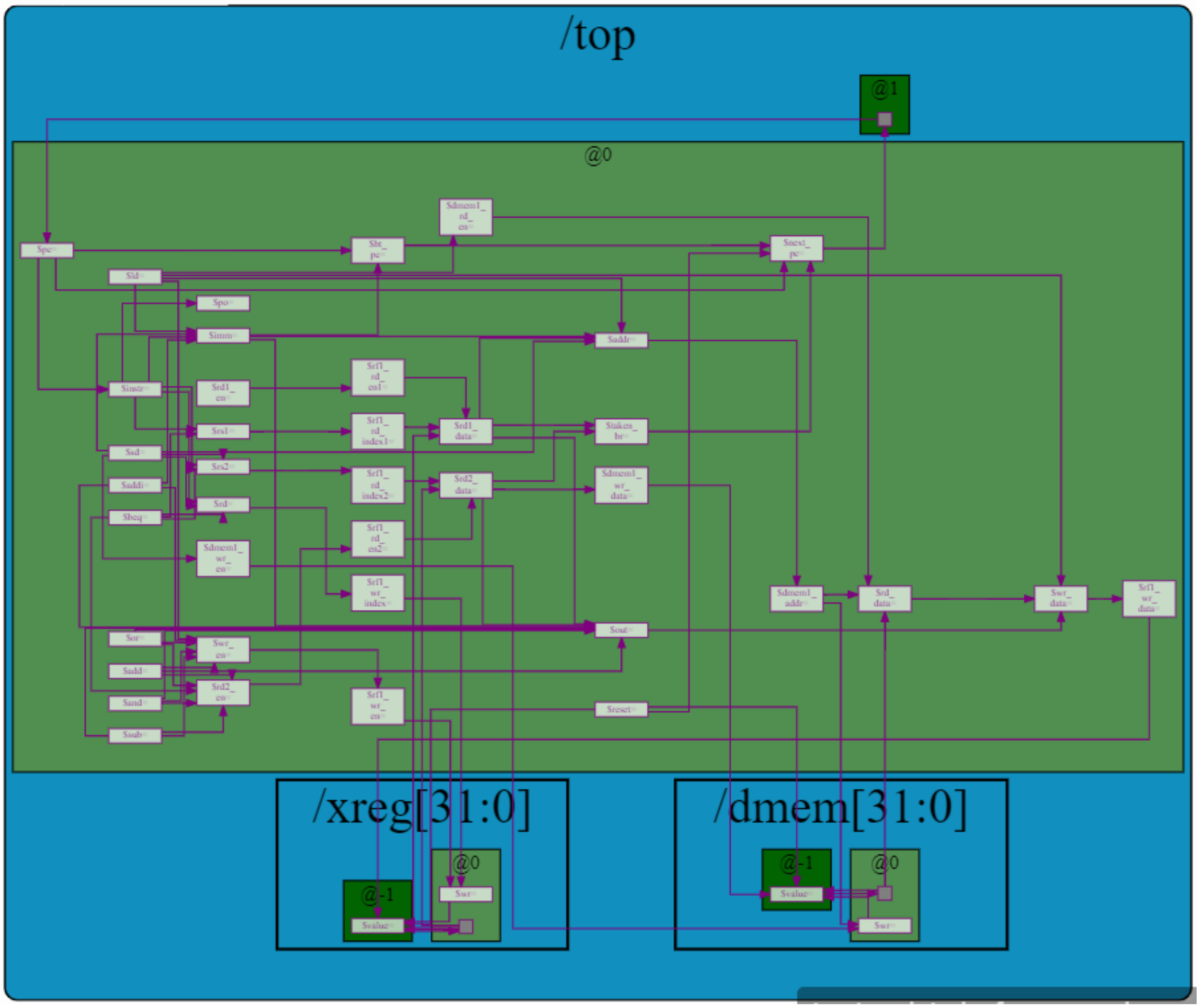
or instruction



store instruction



sub instruction

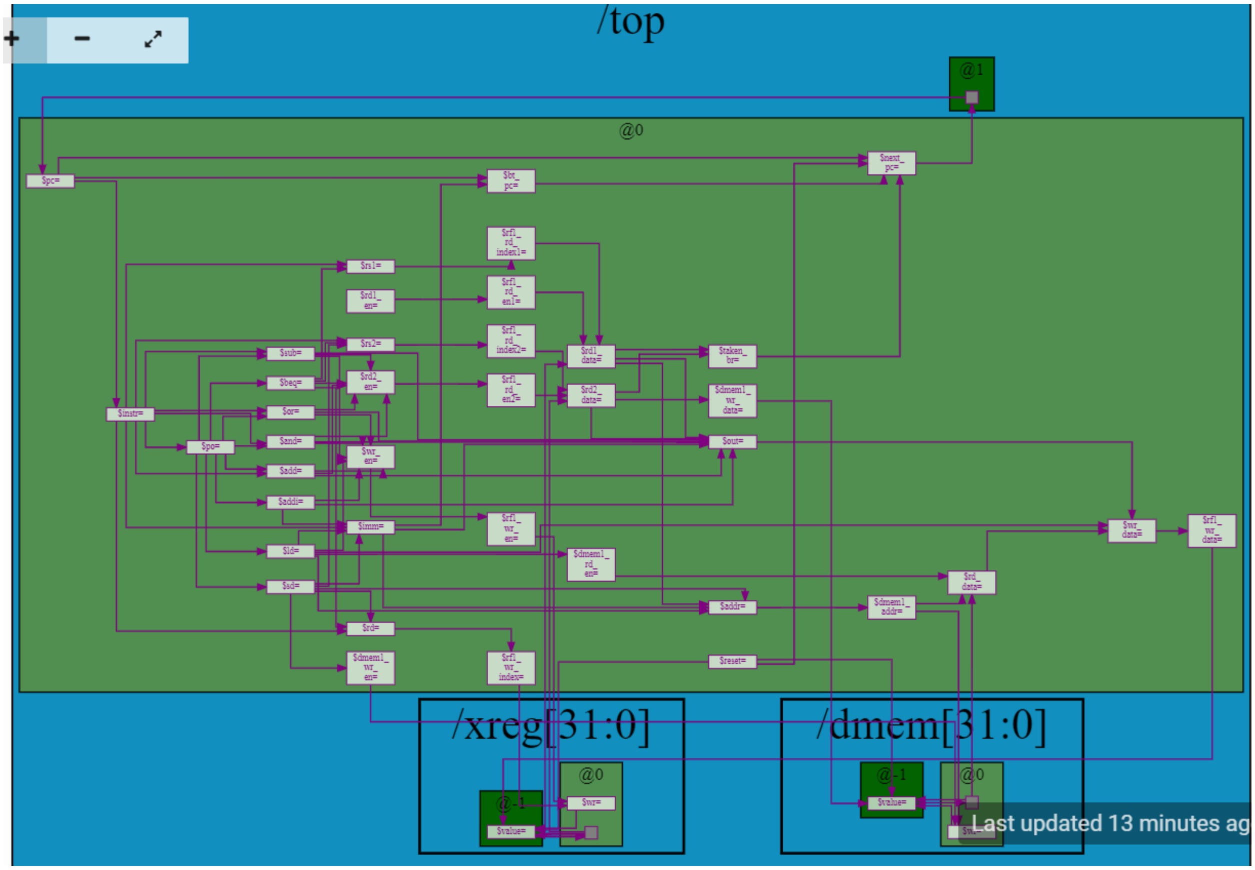


nPower Processor Pipeline

The pipeline is obtained by integrating all the above created modules and including a main control unit instead of hard coding control signals.

Here at every cycle, according to the program counter, the instructions get executed in a pipeline manner.

Block Diagram



THANK YOU!