THE VON NEUMANN MODEL

Model components

* Memory: stores data and program
* Processing unit: performs data processing
* Control unit: in charge of making other parts play together
* Input: means to enter information
* Output: means to retrieve information
Stored program concept

Program is stored in some part of computer memory.
Instructions are represented and stored in memory as binary words.

```
Memory
  Data
  Instructions
```
The instruction

Most basic unit of computer processing
Components:  * Opcode
             * Operands

Example:  \[ \begin{array}{|c|c|} \hline
          & \hline
[15:12] & \hline
[11:0]  & \hline
          \end{array} \]

 Opcode    Operands

Types of instructions:
* Operate: perform operation
* Data movement: move data from one place to another
* Control: change sequence of execution

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Von Neumann instruction cycle

Instruction cycle: sequence of steps in which instructions are loaded and executed

Fundamentally, there are 6 phases:

1) FETCH: obtains next instruction to process

   MAR ← PC
   PC ← PC + 1
   MDR ← M[MAR]
   IR ← MDR
2) **DECODE**: instruction in IR is examined to determine what to do next

   Example: for a 9-bit opcode, we use 4:16 decoder

3) **EVALUATE ADDRESS**: compute memory location needed to process instruction

4) **FETCH OPERANDS**: operands needed are obtained from memory or registers

5) **EXECUTE**: carries out execution of instruction

6) **STORE RESULT**: result is written to designated destination
Control of instruction cycle

Each step is controlled by an FSM