Take home lessons

- Compilation (big picture)
- Virtualization
- VM abstraction
- Stack processing
- VM implementation
- Pointers
- Programming.

Virtual machine: lecture plan

Overview
- ✓ The road ahead
- ✓ Program compilation

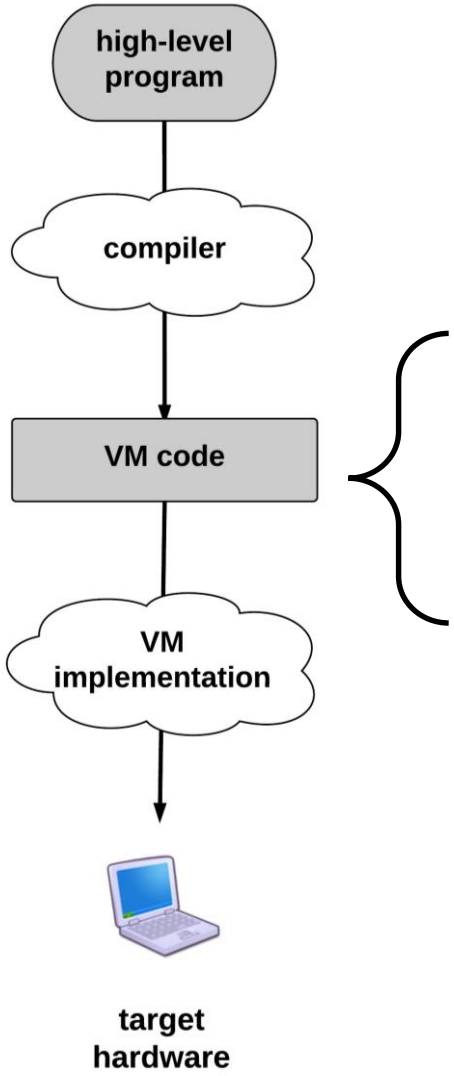
VM abstraction
- the stack
- memory segments

VM implementation
- the stack
- memory segments

VM implementation platforms
- VM emulator
- VM translator

The VM translator
- Proposed implementation
- Building it (project 7)

The big picture



Stack machine abstraction

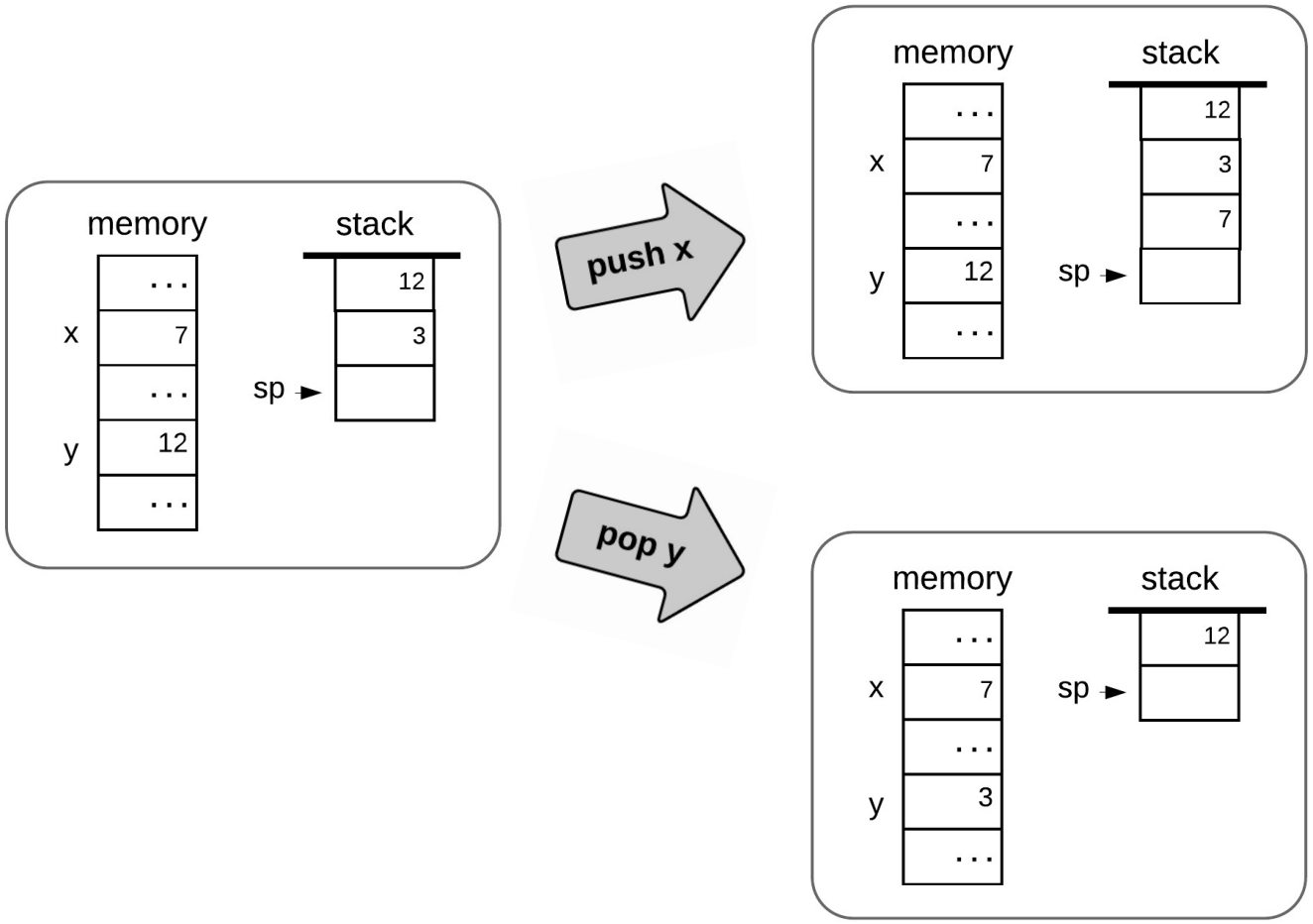
- Architecture
- Commands

Stack

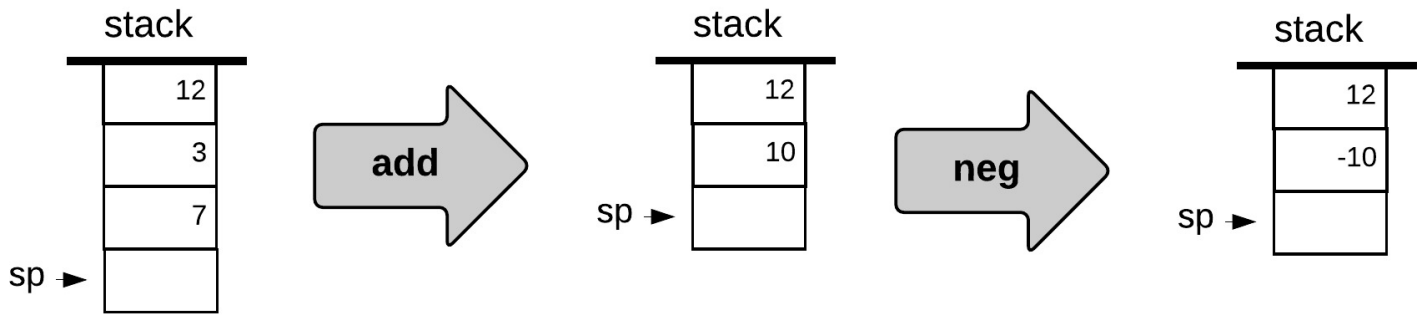
Stack operations:

- `push`: add an element at the stack's top
- `pop`: remove the top element

Stack



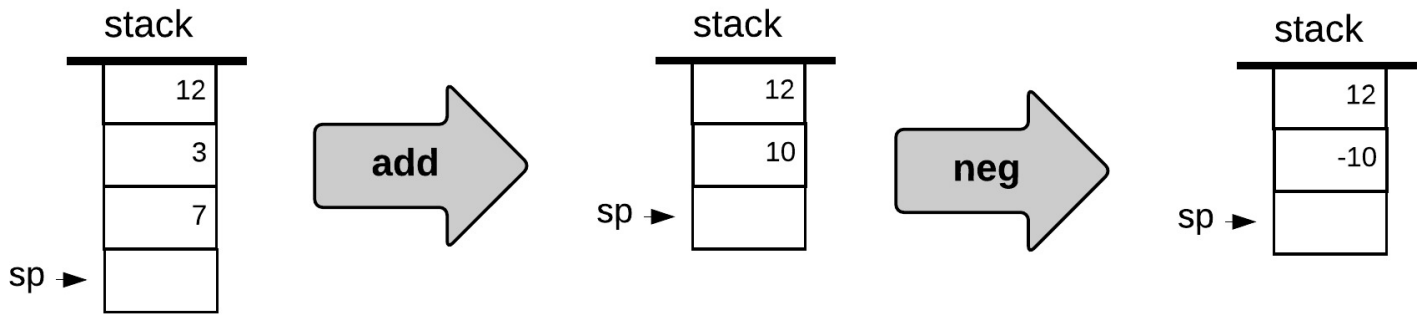
Stack arithmetic



Applying a function *f* on the stack:

- pops the argument(s) from the stack
- Computes *f* on the arguments
- Pushes the result onto the stack.

Stack arithmetic



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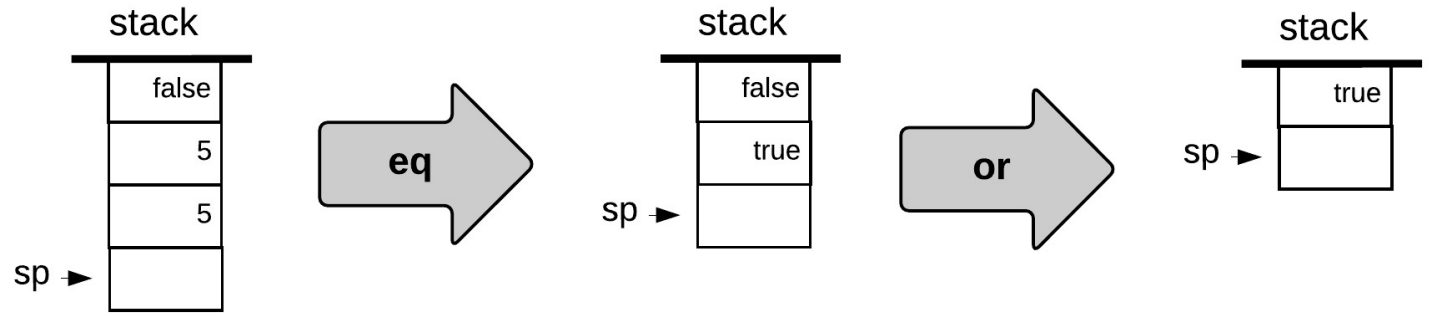

Stack arithmetic (big picture)

high-level

```
x = 17 + 19
```

lower-level

```
push 17
push 19
add
pop x
```

Abstraction / implementation

- The high-level language is an abstraction;
- It can be implemented by a stack machine.
- The stack machine is also an abstraction;
- It can implemented by... Stay tuned.