Computability, complexity, feasibility

Computability

- The computability problem: is an algorithm computable? It has a solution?
- The halting problem: Does an algorithm finish?
  - Video: *The Halting Problem*

In order to answer these questions we need a

MACHINE MODEL

The Finite State Machine

- Its a model to describe a computational automa
- It has a finite number of possible internal state
- The transition from a state to another depends to the actual state and the value of the input

The Turing Machine

- It is a powerful model for describe computational machines
- It cosist of a finite state machine that can read and write to a potentially infinite memory ribbon.
- Any computational model can be reduced to the Turing machine.

Results on computability

- There exists some program that cannot be computed i.e. for which it cannot determine the value.
- There exists some program for which it cannot determine if it finish or not.

Complexity

- For computable programs the is another problem: how time and resources is it required for reach solution?
- For "large" problems, its not so important the exact time spent for resolve the problem but the "trend" respect the "size" of inputs.

O notation

- Given a problem P and an algorithm A that resolve P an input of "size" n for the problem P, the notation O(n) means that for "big" n the time for reach solution is O(n), for ex:
  - O(n)=k , constant time
  - O(n)=n , linear time
  - O(n)=n^2 , polinomial time → P problem
  - O(n)=e^n , exponential time → NP Problem

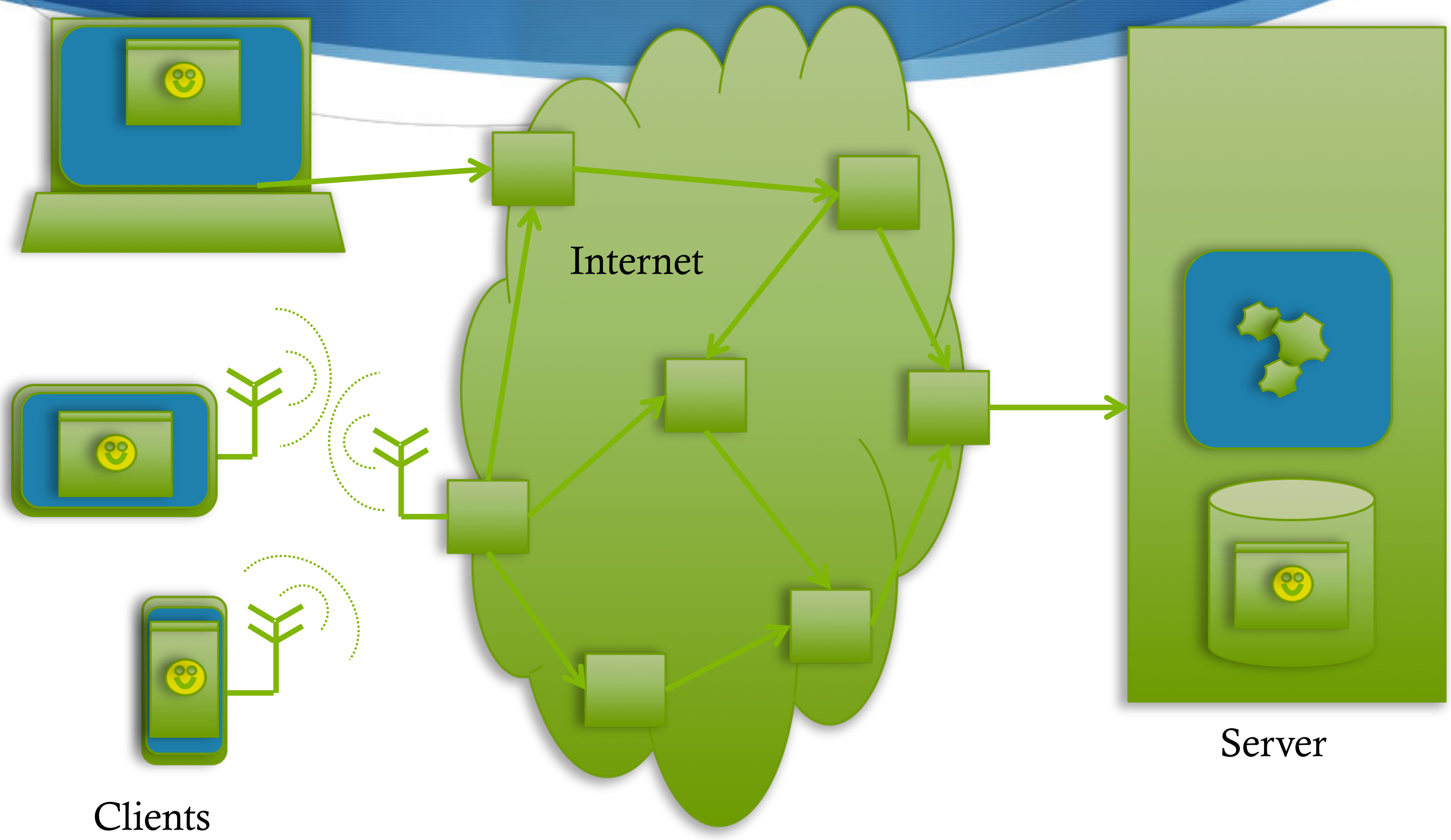
P <> NP Assumption

- polinomial time algorithm has considered "easy" to computes, tough "big" n can be very hard to compute.
- not polinomial time algorithm, for exemple exponential time algorithm, has considered "hard" to computes, tough can be not so hard to compute for "little" exponents and "little" n.
- It is widely assumed (tough not proved) that exists NP problem that isnt P, i.e. that cannot be resolved "easily".

How to resolve a problem

- A programming paradigma it is a "way" to describe a solution method for a problem:
  - imperative languages: C, java, basic
  - declarative languages: ASP
  - functional: prolog

Client-Server Architecture



Client constraints

- bandwidth (mainly smartphone)
- battery (mainly smartphone)
- software capability (OS, supported apps)
- CPU
- RAM
- Disk space

Your app/site must be designed in order to match the expected (and acceptable) constrains on client side

Server constraints

- bandwidth (mainly smartphone)
- Number of contemporaneous sessions
- Disk space
- Cost
- CPU & RAM (less important for a common website)

The server "size" must be designed in order to balance the tradeoff between user experience and cost