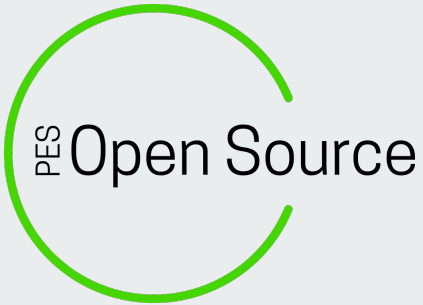
Imperative vs Declarative Systems

Madhav Jivrajani
Ft. Kuby



Introductions

- I’m Madhav (@maddyoiii on slack)

- We have another friend helping us out today

Introductions

- This is Kuby

- A little bit about Kuby:
  - Loves walks and treats
  - Hates baths
  - Unaware of heart-melting potential

Outline for today

- What are these things called automata?
- “Model” of “Computation”
- Imperative systems
- Declarative systems
- Demo!
- Rewind; relating today’s topics to Kubernetes (vot dat)

Auto...what?

- States
  - Finite
- Transitions b/w states
  - Actions
- Start state
- Final state(s)

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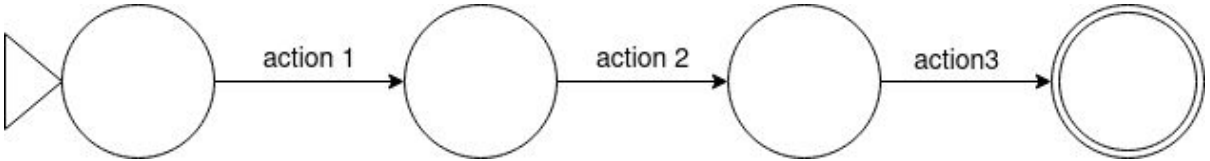


Some lingo

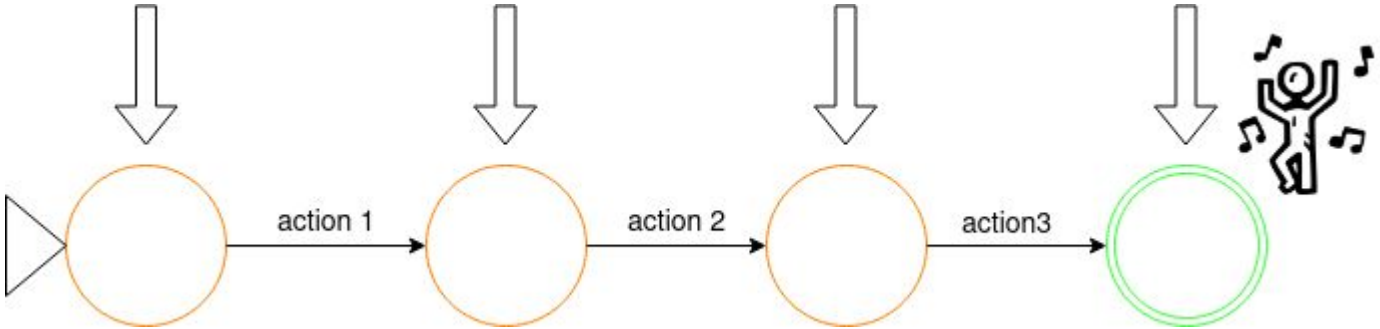
- Desired state
- Mitigating actions
- State match
- State drift

Some lingo

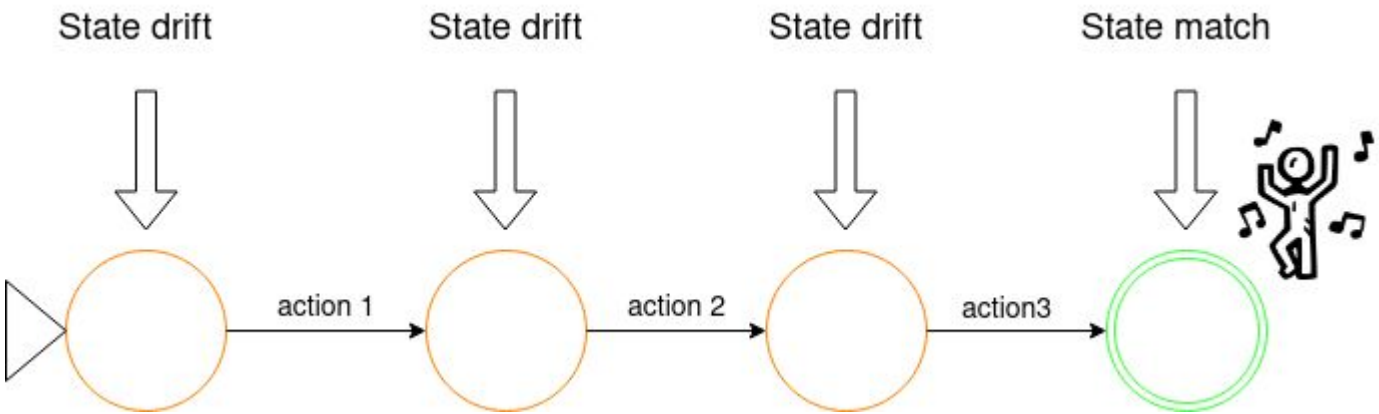
- Desired state
  - Where we would like to be
- Mitigating actions
  - Actions leading to desired state
- State match
  - Current state = desired state
- State drift
  - Current state != desired state

“U GOT THISH” ~ Kubey, 2021

Ohhhh, *automata!*



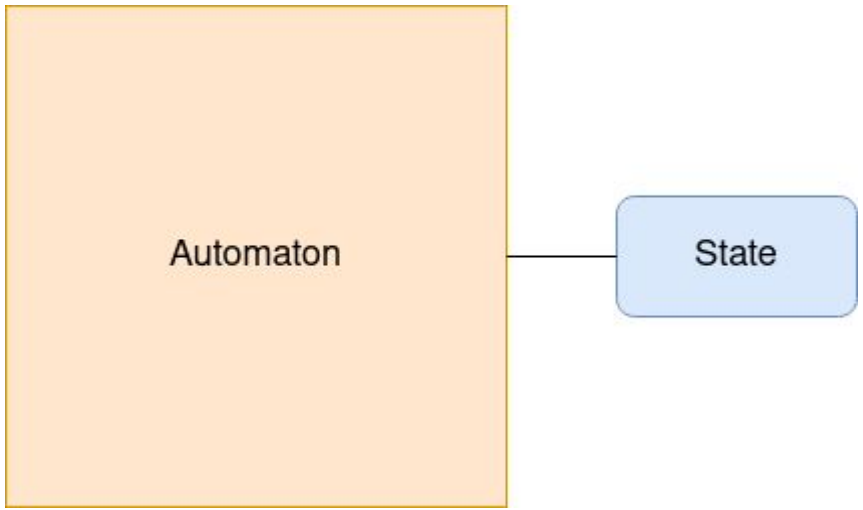
Ohhhh, *automata!*



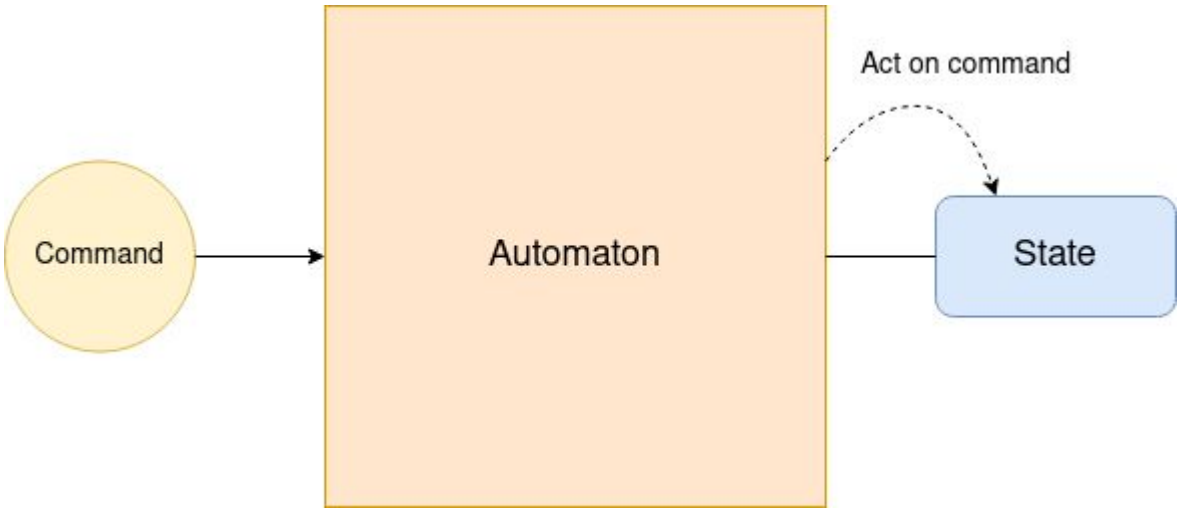
“Model” of “Computation”

- Model?
- of
  - lol
- Computation?

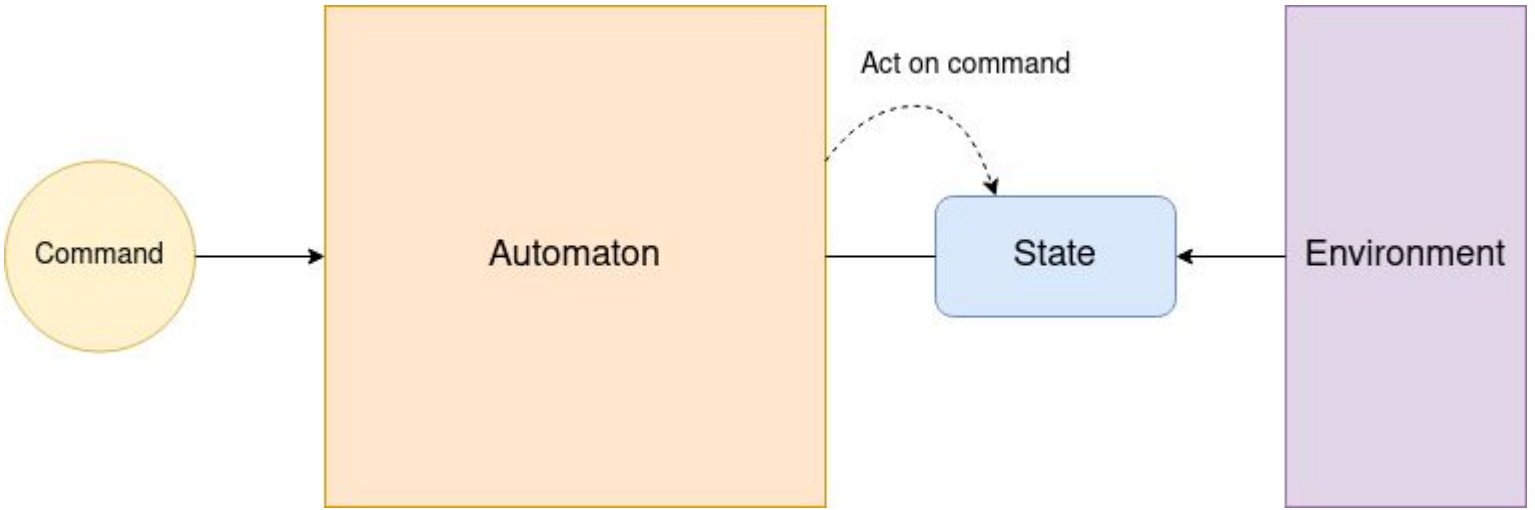
Model of Computation



Model of Computation



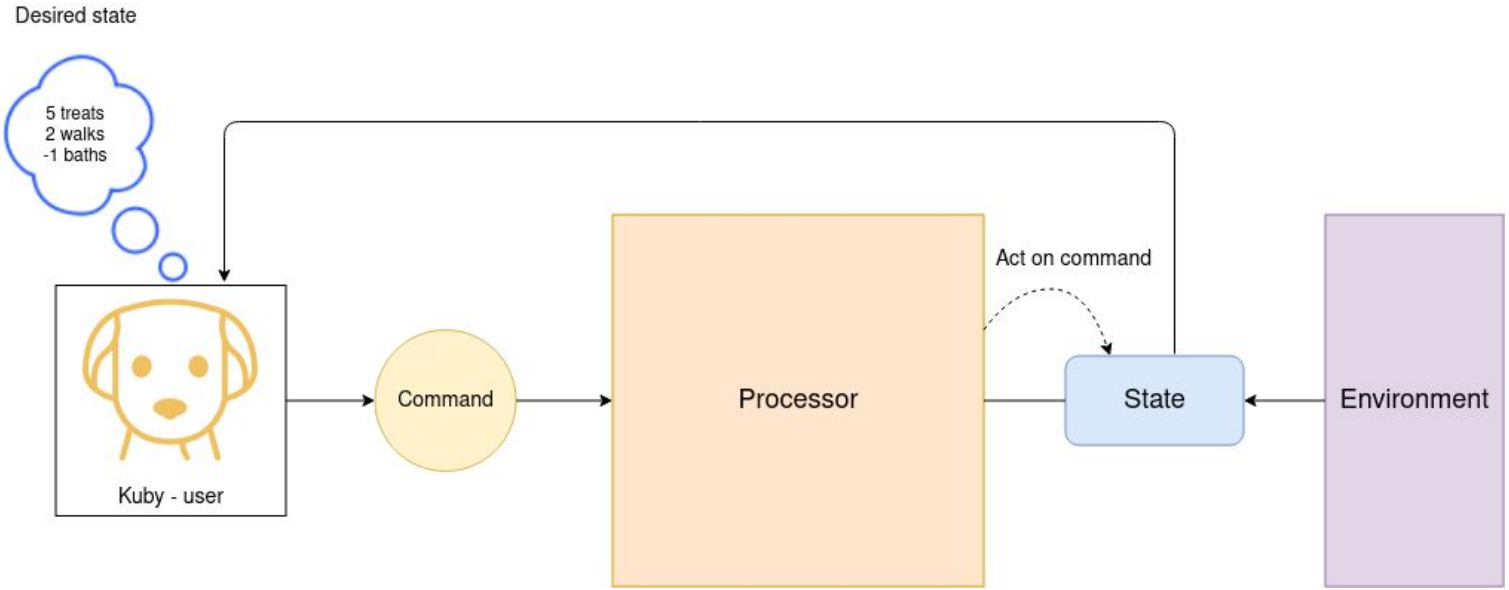
Model of Computation



Imperative Systems

- User knows the desired state.
- User provides “commands” to achieve desired state.
  - Mitigating actions.
- Commands executed by the *processor*.
- What does this look like?

Imperative Systems



Imperative Systems

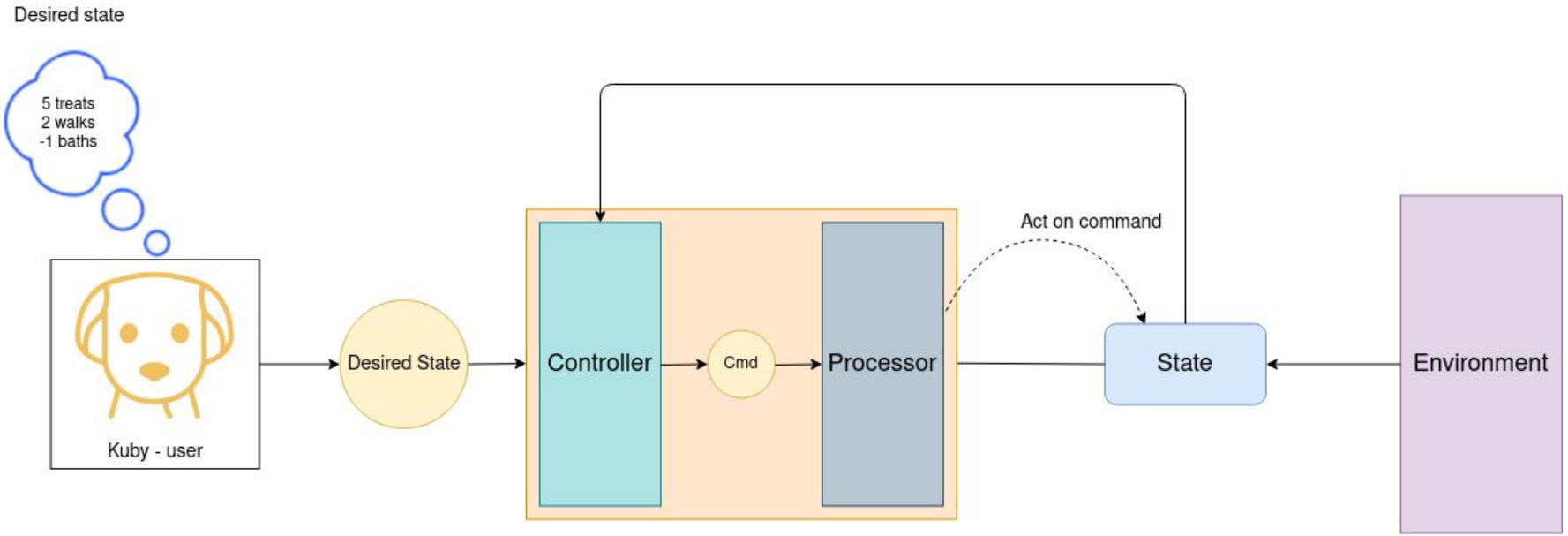
When would you use them?

- Number of unintended state changes is low.
    - For such changes that *do* end up occuring, the user should should be able to provide commands to drive the system towards the desired state.
- When you need stricter control over execution of commands.
- When your system does not need “self-healing” type of capabilities
    - More on this later

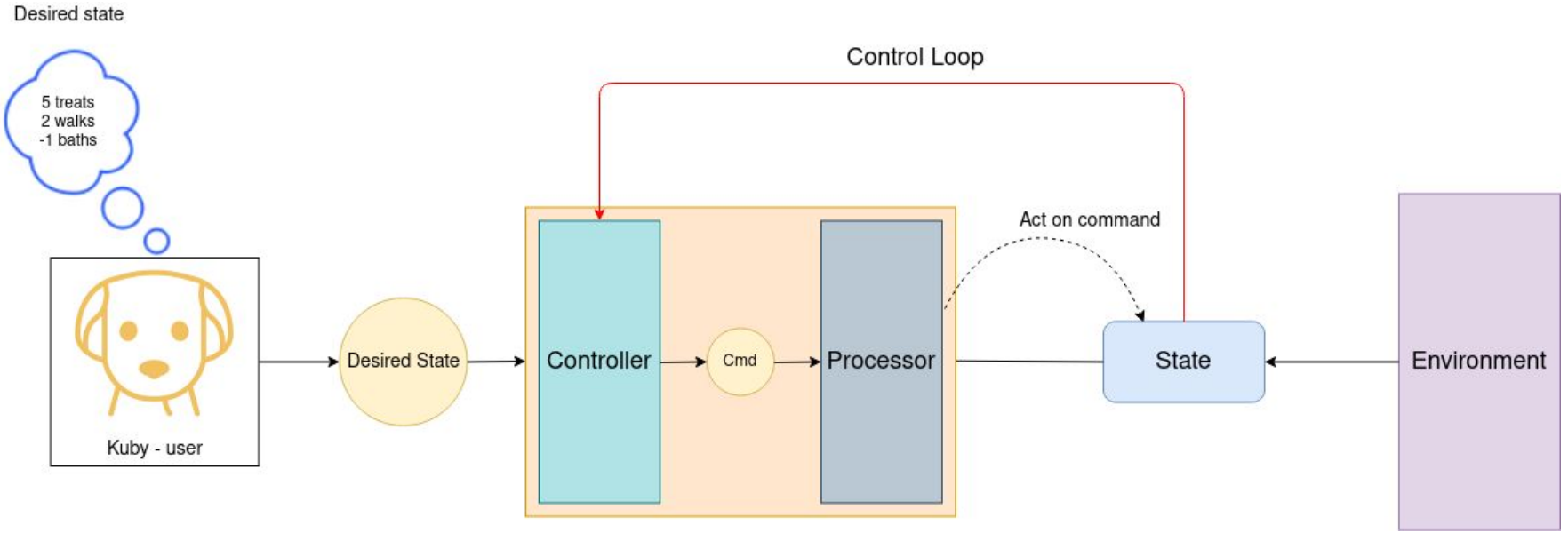
Declarative Systems

- User knows the desired state.
- User provides the desired state to the system.
- The system observes the current state of the system and *issues* commands to move towards the desired state.
    - Component of the system that does this is the *controller.*
- Component of the system that acts on these commands is the *processor.*
- What does this look like?

Declarative Systems



Declarative Systems



Demo!

- `multiprocessing`
  - `Process`
- `flask`
  - `GET`
- PIDs
- Reconciling

Kubernetes and declarative systems

- Current state: `status`
- Desired state: `spec`
- Controller
  - Kubernetes controllers (`kube-controller-manager`)
- State
  - `etcd`
- Processor
  - Kubernetes API Server (`kube-apiserver`)

References

- This whole presentation was inspired by this amazing blog post by *Dominik Tornow*: https://dominik-tornow.medium.com/imperative-vs-declarative-8abc7dcae82e

- Kubernetes documentation for controllers: https://kubernetes.io/docs/concepts/architecture/controller/

Slides and source

Slides and Source code:

https://github.com/MadhavJivrajani/pesos-imperative-declarative

Questions?

Thank you!

“Thankoooo” ~ Kubey, 2021